Proposition d'un

'Centre International d'IA en Acoustique Naturelle'

[CIAN]

Chères et chers Collègues,

Nous avons l'honneur de vous soumettre la mise à jour du projet UTLN de Centre International d'Intelligence Artificielle en Acoustique Naturelle (CIAN), dans la prolongation du projet UTLN PIA4 avec son volet IA bioacoustique "ICoB" soumis en 2022 à Maritime Horizon.

Depuis des années, les activités de CIAN se sont confortées à l'international et au sein de notre université, regroupant à ce jour plusieurs projets communs (ANR, FEDER, projet Européens, thèses…) dans trois de nos UMRs (IM2NP, LIS et MIO) et dans plusieurs de nos URs (COSMER, CERC, IMSIC, IMATH...).

Le projet CIAN draine des recherches et applications fédératrices pour l'UTLN. CIAN est à la connaissance de nos partenaires un projet unique en France et au niveau international. Fort de l'expertise des co-porteurs du projet, nous proposons de le positionner en tant que centre international porté par l'UTLN avec notamment le soutien d'institutions Européennes.

Cette stratégie scientifique permettrait de stabiliser une communication multi-échelle : régionale, nationale et internationale. La création de ce centre permettra à l'UTLN d'accroître son rayonnement et de s'affirmer dans un contexte où la France a pris des engagements internationaux ambitieux de préservation des écosystèmes, notamment en Méditerranée (One Ocean Summit). Retardée depuis 2 ans, cette création placerait l'UTLN comme interlocuteur unique dans la perspective de la troisième Conférence des Nations Unies sur l'Océan (ONUC - Nice juin 2025). Des manifestations CIAN y sont d'ailleurs déjà programmées (ex.: conf. Arts&Sciences coprod. Mangrove, et conf. L181 avec Poivre d'Arvor ambassadeur Océan resp. de l'ONUC). Ce centre a également vocation à communiquer auprès du grand public en répondant aux enjeux de sciences et de société.

Bien cordialement, les co-porteurs de CIAN:

Frédéric Schneider (CERC),
Hervé Glotin (LIS),
Valentin Gies (IM2NP),
Vincent Hugel (COSMER);
Yann Ourmières *associé expert en environnement marin* (MIO).

Suivent la description de CIAN et ses annexes: lettres de soutien de plusieurs partenaires, reçues sur les 24 mois écoulés, et exemples de vulgarisation (attestation de 50 000 visiteurs en une année d'exposition CIAN au MNHN Toulon, spectacles Arts&Sciences...).

DIAPOSITIVES pour une vue rapide :
https://sabiod.lis-lab.fr/pub/CIAN_slides_CAC_202403.pdf

Centre international d'IA en Acoustique Naturelle

International Center in AI for Natural Acoustics

[CIAN]

prepageWeb à basculer (si accord) sur univ-tln

https://cian.lis-lab.fr

Summary

This “International Center of AI in Natural Acoustics” (CIAN) is located at the crossroad of environmental, human and technical sciences based on bioacoustics. CIAN is an international consortium of recognized partners (laboratories, private companies, NGO…), it gathers an interdisciplinary team of experts in Toulon University (UTLN), and a large group of international experts and stakeholders, some having long term collaborations with UTLN. Currently, UTLN runs several projects on this topic which represent 10 000 000 € over a 5 year period.

CIAN, based on international skills in research on artificial intelligence for machine listening, embedded and low power AI, bioacoustics and robotics, aims at developing and stabilizing its strength. This Center will demonstrate within a unified methodology bioenvironmental effects of anthropic factors, such as anthropogenic impacts (noise pollution, ship collisions, terrestrial transport noise, restoration…) leading to habitat and biodiversity losses, in a long term view as well as in very short term emergency situations. CIAN will research innovations to assess and regulate in all parts of the world these increasing troubles.

Keywords : Bioacoustics, Anthropophony, Biophony, Interpret, Model, Prevent, AI, Microelectronics, Optimized arithmetic, Low power, Semi-supervised / unsupervised representation learning, Embedded AI, Inference, Interaction, Adaptation, Cybernetics, Biodiversity, Animal communication, Legislation

Main goals of CIAN

A key objective of CIAN is to become a strong center for professionalization in the bioacoustical domain, and a whistleblower for long or short term environmental changes, or in emergency situations, having diagnostics based on state of the art tools for monitoring based on bioacoutics and Artificial Intelligence.

CIAN will define its policy according to its consortium priorities, taking into account societal and environmental concerns, as well as technical possibilities. An important aspect of this center is that it will gather recognized partners in bioacoustics and connected environmental sciences, laws, economics, engineering sciences in order to define key objectives jointly in several fields : environmental of course, but also technical in order to push the boundaries of the state of the art in terms of monitoring and alerts, in order to make regulations evolve, for example.

CIAN will help to maintain and develop the existing large collaborative working framework based on widely accepted standards and goals. It will also promote environmental protocols for external contributors such as citizen scientists forming a huge and particularly interesting network, in order to make them able to contribute efficiently to science. Objectives will be proposed by the consortium, according to the state of art in measurement techniques and sensors. Moreover, desirable technical evolutions in sensing techniques will also be defined by CIAN and developed accordingly. These will focus on two main challenges :

- **Long term monitoring** : how to make long term reliable environmental monitoring, especially for building reference models that can be used in one or two human generations. This involves :
    - developing high performance (low noise, high fidelity) innovating very-long term recording hardware with extended capabilities such as focusing on defined species recognition in ultra-low power or tracking animals in a passive way using networks of

ultra-low power sensors. This is based on electronics, embedded signal processing and ultra-low power artificial intelligence.
    - developing cheaper hardware for helping citizen scientists.
    - developing high performance offline classification techniques for better identifying animals. This is based on high classification performance artificial intelligence.
    - developing tools for deploying monitoring hardware efficiently, if possible at a low human and material cost. This is mainly based on robotic techniques.
    - developing or finding reliable and sustainable long-term database solutions for storing and organizing bioenvironmental data.
- **Surveillance :** monitoring of specific terrestrial areas (Nature Reserves, National Parks, other protected areas) to detect in real-time possible threats or illegal activities, such as hunting, unauthorized motor vehicles, illegal tree felling by chainsaws.
- **Emergency monitoring** : how to monitor natural areas in the long term in order to detect abnormal behaviors or flash pollution, and how to deploy efficient measurement tools in emergency situations for evaluating the potential impact of these pollutants on the environment. This involves :
    - developing advanced collaborative human-robot techniques in hazardous environments (potentially underwater), and possibly bio-inspired techniques. This is mainly based on robotics, electronics and signal processing and AI for improving communication between humans and robots, and between robots and robots.
    - developing advanced intelligent ultra-low power embedded detection systems. This is mainly based on electronics and ultra low-power artificial intelligence.

Strengths and originalities of CIAN

- Strong experience in cooperation at local and international levels, between bioacoustics, AI, electronics, technical scientists and researchers in economics and law.
- Experience in designing, defining and building innovative advanced scientific instrumentation for sound monitoring as shown since 5 years in SMIoT Toulon University. This includes low-power aspects, as well as embedded artificial intelligence capabilities, at an interesting quality-price ratio and a versatility of use[1].
- Experience in developing and maintaining IoT biodiversity stations in Med. Sea and Natural reserves, but also all over the world, as we did in CARIBBEAN CARIMAM, in several Fjords (Patagonia, Norway, Canada, Mediterranean Sea), forests as in Amazonia.
- Experience in monitoring the acoustic environment of Nature Reserves in Italy in cooperation with the Biodiversity Dept of Carabinieri, Italy.
- Experience in developing specific algorithms for acoustic analysis according to the needs of stakeholders and constraints from the field.
- Experience in robotics for deploying measurement tools and cooperative robot swarms in hazardous environments.
- Experience in perception, production and evolution of animal communication systems.
- Strong commitment in education and training.

- UTLN supports research, innovation and discovery with a view to respecting the environment and sustainable development for the preservation of marine ecosystems with more than 53 projects carried out by its laboratories in 2022, mostly dedicated to marine biodiversity in the Mediterranean, for a mobilization of 25 M€ over the last decade by funding and partnership. UTLN is notably the co-sponsor of two PIAs projects (TERRA FORMA and PSIBIOM) on the theme of biodiversity monitoring by bioacoustics and IA ADSIL Chair, as well as of 2 ANR projects (ULPCOCHLEA, SYLVANIA) a FEDER MARITIMO, 2 BIODIVERSA and other int. projects.

Outcomes for the Society at local and international levels

- Building a recognized scientific trustable bioenvironmental whistleblower for long term bioenvironmental changes and emergency situations.

[1] http://sabiod.lis-lab.fr/pub/QHB.pdf

- Collaboration and involvement of recognised partners for paving the way toward innovating technologies to monitor and solve real problems, mainly related to the environment.
- Public awareness on the topics of the project : exhibits, websites, multimedia products.
- Development of citizen science thanks to improvements in cheap reference monitoring instruments and shared long term data storage.
- Formation and training for ONGs and for personnel of the Public Administration (Forestry Police, National Parks, Nature Reserves)
- Collaborative science advancement and diffusion (research, scientific papers, conferences, summer schools, divulgation papers, books)
- Education and formation of experts (Schools, Universities, PostDocs, PhDs, summer/winter schools)

Sub-objectives

- Create and build advanced scientific instruments with very low power consumption, on-board computing capacity, good value for money and high versatility for sound monitoring at sea and on land, including a 10-fold reduction in the cost of systems offered by foreign monopolies. These innovations will be sold by the UTLN subsidiary to stimulate protocols and quality knowledge acquisition at low cost. This is the principle realized by SMioT UTLN technic platform (> 100 K€ of turnover / year).

- Develop and execute new AI-specific algorithms for acoustic analysis in response to observed shareholder needs and field constraints. This will include representation learning as proposed in recent A+ publications of the group in the major conference in the field in collaboration with Rice University.
- Professionalize students in bioacoustics to best prepare them to respond to future environmental challenges on topics such as climate change monitoring, ecosystem fragmentation, ecosystem restoration and anthropizations (anthropophony), wildlife behavioural responses.
- Participate in the decision-making process of public policies by proposing state-of-the-art expertise on biodiversity issues through bioacoustics. To disseminate internationally the renowned know-how of UTLN in this field and to intensify a network of users and experts.

CIAN deals with the disturbances of wind turbines and transport on land or sea, answers to the DCSMM laws towards anthropophony. It is monitoring pollution correlated to biophony and noise recognized in environmental law and leading to a regulation of noise emissions. The tasks of CIAN are each linked to a cluster of training degree / master / doctorate, with request of our partners for internships in their company, and reciprocally request of lifelong learning of our partners. CIAN is based on 30 tenures of UTLN, including the team DYNI at LIS always evaluated A+ by HCERES since its creation 12 years ago. The excellence of the research and teaching in bioacoustics in CIAN will still be evaluated by the standard of HCERES criteria, with regular auto evaluation and external evaluations by an international jury.

Indicators of success: CIAN will apply similar indicators regarding the professional integration of graduate students and their hiring after 18 months. The involved PhD grants will be monitored to check its progressive increase. External collaborations, consulting over 10 years shall increase by 20% as the co-funded research projects (CIFRE but also others). Two Chairs in bioacoustics will be created. Three International workshops organized by CIAN will have to be published in special issues of A rank international journal.

Associated partners: several ministries concerned with the subject (MTES, Min Mer, MI, MEAE); institutes CNRS (INSB, INEE, INSU, IN2SI), INRAE, INRA, Ifremer, laboratories such as UMR LAMFA at Jules Verne University in Amiens, UMR LEHNA Lyon, MNHN Paris, UMR MARBEC Montpellier, J. Rond d'Alembert center, Sorbonne University, IMBE IRD Avignon, CPPM AMU towards KM3Env obs., and UMR ENES St. Etienne. international labs: CIBRA (U Pavia, IT), U Acorez (Portugal), U Jamaica, U Concepcion and Patagonian center (Chile), U Fed Rio Grande do Norte (Brazil), U Thessalonike (Greece); U Tokyo (in convention towards Fukushima bioacoustic survey), AWI (De); industries : OSEAN, FBV Marine, SemanticTS, Akvaplan (No), large groups (EDF, Engie, TotalEnergies, Naval Group, Fincantieri...). OceanoScientific; public establishments including PNPC, SHOM, Monaco Ministry of Environment, CapCors Park, DGA; ONGs e.g. CCS, Longitude181.

Impact on students: steady diversification in academic and applied job profiles, supported by positions and funding ; students to get involved in the international, national and local network that involves 80 professionals in research & development or stockholders.

Impact on academic community: interdisciplinary team, from sensors to decision, from acoustics to AI, from biophony to biodiversity.

Impact on the sector: Building a recognized scientific trustable environmental whistleblower for long term environmental changes and emergency situations. Collaboration and involvement of recognized partners for paving the way toward innovating technologies to monitor and solve real problems. Innovating advanced Machine listening by AI on missknown or endangered biodiversity. Deploy CIAN know-how in scaled projects as the PSSA opening in 2023 : the largest ZMPV in the whole NW Med Sea (FR, IT, SP, MO).

Impact on the territory: local and international network for efficient and competitive professionalization in bioacoustics, artificial intelligence and instrumentation for environmental monitoring; development of citizen science thanks to improvements in cheap reference monitoring instruments and shared long term data storage; training for ONGs and of Public Administration (Forestry Police, National Parks, Nature Reserves); collaborative science advancement and diffusion (research, scientific papers, conferences, summer schools, divulgation papers, books). Public awareness on the topics of the project: exhibits, websites, multimedia products.

Tasks

CIAN is decomposed in 9 tasks as follows:

T1) Design, build and distribute versatile scientific instrumentation with embedded AI

T1.1 Design of new advanced IoT protocols for Biodiversity survey

T1.2 Research and construction of advanced scientific low power IoT instrumentation over the 10 years

Milestones / deliverable = involve students into professionnalisation to innovate hardware architecture to measure and process / interact and assess novel knowledge and models, every two years, a novel main project and delivery of solutions. Students will be involved in the process of co-creation, design, validation and calibration of the instruments and their applications, with two main meetings a year in a form of hackathon on hardwares and competitions. 2 international A+ publications each year and internship for professionalization

T2) Field implementation and international community networking for IoT biodiversity

T2.1 Fostering new and strengthening existing international relations:
Extension and reinforcement of CARIMAM network, in Bahamas, Jamaica, Bonaire, Guadeloupe, Martinique, StMartin, St Barthelemy, Dominique, Agua, St Eustache, in biodiversity hot spot and / or where there is increasing ship traffic and an overlap with megafauna habitat

T2.2 Citizens science programs, link to school and university level : a big campaign every 2 years

T2.3 BOMBYX2 deployment in MedSea and elsewhere : +2 sonobuoy per year (today 12 Bombyx are programmed) ; stockholder network ; collaboration with the PREMAR, Monaco, Italy, Pelagos, Spain

T2.4 Reset of Caribbean 'CARIMAM' international network : updated material and 12 months recording, each 2 years, 5 times

T2.5 UTLN joint partner missions to deploy observations and actions, and networking (Med Sea, Arctic, Mozambique, Patagonia, Polynesia…). Sea and terrestrial missions 1 or two each year, 4 to 8 weeks x 10 times.

T2.6 Extension of the CIBRA-CNRS SABIOD-Italy monitoring project in Italy to include more sites, either terrestrial and marine, to cover a wider range of habitats; set up an online repository of recordings and datasets. Implementation of real-time access to data in selected sites.

T2.7 OceanoScientific Mission, for students and professionals working together, included in kind of 100 K€ / year.

T2.8 International network for the survey of of coastal dolphins with Chilean researchers (U. Austral de Chile, U. santissima Concepción).

Milestones : Internship for professionalization with key partners. These networked realizations will involve students and partners in collaborative professional projects and will give them international skill in several related domains.

T3) Develop and apply novel algorithms in artificial intelligence to massive acoustic data

T3.1 Research in specialized algorithm for Embedded detection, localisation, categorisation of sources : over the 10 years, new EC

T3.2 Research in decision making and interactive IoT : over the 10 years

T3.3 Involving students in AI, computer sciences robotics for biodiversity studies

Milestones : This task will strongly link the know-how in machine listening to the students, giving them professional skill in effective bioacoustics, with A+ publications and intense internships in companies and labs.

T4) Living, analog and numeric communication systems

T4.1 Living Communication : evolution, adaptation to noise

T4.2 Analogic communication and interaction systems for advanced robotics

T4.3 Biomimetic robotics

Milestones : international skill given to the student and A+ publications each year and internship for professionalization.

T5) Monitoring ecosystem fragmentation and animal behavioral responses to anthropic pressure

T5.1 Climate change

T5.2 Anthropisation & Fragmentation

T5.3 Ecosystem restoration

T5.4 Ethological and ecological responses to anthropogenic noise

Milestones : international A+ publications each year and internship for professionalization

T6) Legislation for prevention and protection

T6.1 : Comparison of the results of the sound monitoring with the existing state of law (laws, regulations, principles, case law, etc.)

T6.2 : Proposal for regulations at International (International Maritime Organization), European (Maritime Spatial Planning) and National level (adaptation of strategies and regulations for the protection of marine mammals, the prevention of the risk of cetacean-ship collision, the limitation of harassment caused by pingers, etc.). Eolian survey.

T6.3 : Proposal for regulations for terrestrial anthropophony, and monitoring of biodiversity in Nature Reserves and National Parks versus anthropized and restored areas.

T6.4 : Actions with the National Parks and networks of Nature Reserves - e.g. EU Natura 2000 sites, ZMPV…

T6.5 : Implementation and adoption of innovative methods and techniques resulting from research

Milestones : International A+ publications each year and internship for professionalization

T7) Teaching by and for research & development

CIAN allows the students to get involved in the international, national and local network of CIAN that involves nearly 90 professionals in research & development or stockholders. CIAN also proposes lifelong education and training to citizens with citizens science programs for students at school and university level, ONG and PA personnel for environmental monitoring and protection, because the theme of biodiversity surveying by bioacoustics and automatic machine listening at sea and on earth is constantly evolving.

The dense teaching and professional network of CIAN allows many courses including Phd programs that will offer professional skill to the students :

CIAN offers summer schools (ERMITES 2024) and prepares a Tropical School in Polynésia Moorea, headed by ENES (cf https://cian.lis-lab.fr/teaching).

CIAN opens many international hackathons, as in lifeClef 2015 etc, College de France data challenge 2021 and 2023,... in which hundreds of int. teams participated.

Professionalization by and through research in CIAN will consist, for the partners, in more or less fully outsourcing activities for which skills they do not have are necessary. For the university, this professionalization also allows it to play a role in the public development policies of a territory on the strategic and operational levels. The strength of CIAN is a local and international network for efficient and competitive professionalization in bioacoustics, artificial intelligence and instrumentation for environmental monitoring.

Bioacoustics is the science of animal and environmental sounds, at sea or on earth. It is a booming scientific field, with very strong academic and applied career potential. As bioacoustics become used in a wider range of fields, new sub-disciplines are regularly emerging (e.g. eco-acoustics, animal / machine interactions, freshwater acoustics, welfare acoustics...) leading to a steady diversification in academic and applied job profiles, supported by positions and funding.

Due to its strong network, CIAN will help to coordinate several formations of Toulon with other existing recognized formations in France such as the leader St Etienne university (International master of Bioacoustics, Bioacoustics Winter School), and in Italy etc., resulting in a great opportunity for student professionalization in CIAN on bioacoustics and AI for bioacoustics, machine listening, instrumentation and decision :

In 2024, CIAN joined MathAData : the Maths by Natural Experimentation (https://mathadata.fr). MathAData develops data sciences from high school to doctorate. Therefore CIAN builds a data challenge on superpredators discrete calls from arctic to tropic : the challengers will have to automatically recognize the species

UTLN welcomes the prestigious Erasmus Mundus scholarship that UTLN leads (R. Marxer and V. Hugel): an international master's degree in excellence in intelligent marine and maritime robotics (MIR). This master will participate in training towards CIAN, along with other Masters.

Bachelor : UE B65 bioinformatics (2 ECTS). UE 23 Embedded systems (2 ECTS). UE 33 & 43 Embedded systems and Robotics (4 ECTS)

Seatech Sysmer : Electronics - Analog and digital (3 ECTS), RIE embedded electronics for robotics (3 ECTS). INCOM communications in embedded systems (3 ECTS). Real Time Operating Systems (3 ECTS). MICROC power electronics (3 ECTS), Embedded AI (3 ECTS).

Master SDM parcours IPA Anthropic Pressure (IPA) : UE23 Marine organism adaptation and bioacoustics (3 ECTS). UE32 Population survey by bioacoustics (3 ECTS).

Master in computer sciences (DID) : UE12 data processing, signal processing Machine Learning (3 ECTS). UE22 Database, signal processing (3 ECTS). UE32 Automatic pattern recognition (3 ECTS). UE34 Research and professionnalisation (3 ECTS).

Master robotics (ROC) & SEATECH : UE11 Skills 1 (mutualized) : Collaborative project, English (2 ECTS). UE12 Robotic modeling : Modeling of mechanical systems, Modeling of marine systems (3 ECTS). UE14 Learning : Unsupervised learning, Supervised learning, Reinforcement learning (3 ECTS). UE15: Electronics & Telecommunication : Analog signal processing, Electronics for radiocommunication, Embedded digital electronics (3 ECTS). UE21: Skills 2 (mutualized) : Initiation to research (Documentary methodology), Collaborative project, English (2 ECTS). UE22: Mechanical robotics : actuation and perception chain, Biomechanics (3 ECTS). UE23: Optimal control : Optimization techniques, Nonlinear control theory (3 ECTS). UE24: Statistical deep learning : Vision-based deep learning, Multimodal perception (3 ECTS). UE25: Embedded and connected systems : Digital sensors and buses, Networks and wireless communication, Instrumentation and sensors (2 ECTS). UE31: English 3 & Job search techniques-Initiation to research (2 ECTS). UE32 Robotics and applied nonlinear control Underwater drones Bio-inspired robotics Robotic control (3 ECTS). UE33 Applied artificial intelligence Simultaneous Localization and mapping - Behavior, decision-making and prediction (3 ECTS). UE34 Internet of Things-Connected objects & Real time systems (3 ECTS).

Master Law : UE6 International law in sea, state regulation, learn fundamentals of law in maritime domain, and economical development blue growth (3 ECTS).

Master Economy : UE32 Risk and environment at sea (3 ECTS).

Master international MIR MUNDUS UTLN, Norway, Spain, Portugal : UE Perception and Manipulation (4 ECTS), UE Multi-robot systems (previously cooperative robotics) (4 ECTS), UE Cognitive processes (4 ECTS), UE Underwater wireless communication (4 ECTS), UE Robotic Intelligence (4 ECTS), UE Transversal skills (4 ECTS), UE Optimization and algorithms (4 ECTS),

UE Decision systems (4 ECTS), UE Autonomous systems (4 ECTS), UE Embedded Computational Systems (4 ECTS), UE Distributed Real Time Control Systems (4 ECTS), UE Telecommunication Networks (4 ECTS), UE Entrepreneurship, Innovation and Technology Transfer (4 ECTS).

University Diploma : Bioacoustics Summer school (BSS) in the continuity of UTLN's ERMITES summer school (2006 to 2016), will be opened by CIAN in complement to the Bioacoustical Winter School of St Etienne / ENES. BSS will focus on marine bioacoustics, with field training and Artificial intelligence for machine listening and also instrumentation of bioacoustics and embedded electronics. It will last 2 weeks (6 ECTS).

St Etienne univ. partner: The International Master of Bioacoustics (MoBi https://www.masterofbioacoustics.com/), is a unique one year international and excellence training programme entirely taught in English. It welcomes French and international students from diverse academic backgrounds: acoustics, ethology, ecology, biological conservation, evolution, neuroscience, informatics, signal processing… The aim of the MoBi program is to provide thorough knowledge and skills for students aspiring to access doctoral training in bioacoustics-related fields, or environmental consultants aiming to incorporate bioacoustics in their skillset. Co-organized by Nicolas Mathevon and David Reby (ENES lab, both IUF senior professors), it is a highly competitive international graduate course. It is structured according to the European Credit Transfer System over two semesters of full-time studies (60 ECTS).

MoBi corresponds to a second year in the French master curriculum (M2). It is currently a pathway (parcours) of the Master of Ethology of the University of Saint-Etienne and of the International Master of Acoustics of the University of Lyon. However, it is not necessary to have followed the M1 of the Master of Ethology or the M1 of the international master of Acoustics to apply. MoBi leads to the award of the French national master's degree in Ethology (bioacoustics pathway) as well as the University Diploma in Advanced Bioacoustics of the University Jean Monnet.

The master MoBi comprises 10 one-week taught modules (3 ECTS each) + an empirical project (6 ECTS) + a six-months internship (24 ECTS) : Bioacoustics in the field (3 ECTS), Comparative bioacoustics I Birds and Reptiles (3 ECTS),Comparative bioacoustics II Terrestrial Mammals (3 ECTS), Eco-acoustics 1 (3 ECTS), Comparative bioacoustics III: Marine Mammals (3 ECTS), Eco-acoustics 2 (3 ECTS), Underwater bioacoustics (3 ECTS), Temporal structures and Rhythm – Insect and amphibian bioacoustics (3 ECTS), Welfare & Laboratory (rodents) Bioacoustics (3 ECTS), Human Vocal Communication (3 ECTS), Empirical project finalization: open door week & technological fair, Empirical project assessment - oral presentations (6 ECTS), Internship (24 ECTS).

University Diploma : “Bioacoustics winter school” (BWS) opened in 2016 at the University of Saint-Etienne. It is a training opportunity in Bioacoustics, to get expertise. It is a highly popular University Diploma organized over two weeks each January, (6 ECTS).

Sorbonne univ : international workshops, DCLDE, co-organised in Paris with UTLN, and in Waikiki on the Island of Oahu, March 2022. and Rotterdam 2024. As with previous workshops, common data is provided to allow participants to directly compare algorithms and methodologies to involve professionals. This workshop series has been successful in advancing the field by providing a forum for researchers to share/compare methods, and build collaborations. The series has also served as an entrance point for students and researchers new to the field.

Pavia Univ, Italy : UE Bioacoustics (6 ECTS), UE Applied Ecology for the Master Degrees “Nature Sciences” and “Experimental and Applied Biology”, Bioacoustic laboratory for MS Thesis preparation (3 ECTS), UE in the LIFE Project ESC360 (2019-2021): Lectures in international masters. Teaching and tutoring in ERASMUS and ERASMUS+ (4 ECTS).

Valdivia, Chile : Workshop and teaching on marine and terrestrial bioacoustics “Curso Internacional, Estudios avanzados en bioacústica en ambientes acuáticos y terrestres: teoría y aplicaciones”, january 2024 by Franck Malige and Julie Patris in CIAN (12 ECTS).

T8) Popularisation and communication

CIAN is involved in several popularisation and communication actions, as Art & Science programs as for UNOC. Demos are in https://cian.lis-lab.fr/artshows/
and https://cian.lis-lab.fr/seminaires/
https://cian.lis-lab.fr/medias/

As previously in our former project (http://sabiod.univ-tln.fr), we will participate in movies and radio programs to communicate on CIAN teaching and research activities (http://sabiod.org/tv).

We will also run, based on the 50 000 visitors of our exposition 2023 2024 (see annex), a permanent exhibition in La Maison de la Mer, in Sanary, where 100 m2 is dedicated to CIAN activities (to open in 2025, permanent exhibition, in convention).

T9) Coordination of the project, management

T9.1 International workshop organization, 1 / year "Instrumentation, AI, acoustics and ethology for climate and anthropic pressure". Will invite professionals in bioacoustics and biodiversity monitoring, labs and students to meet and get involved in common projects. These meetings will be jointly organized with our national and international partners and will in majority be placed in UTLN campus.

T9.2 Links and discussion, coordination, with international instances, as the United Nation, OMI, NOAA, Canadian fisheries, and national instancies, redaction of the "rapport de conjoncture" du CNRS on AI for environmental survey, ministry of "transition écologique", PREMAR, National Parks,...

T9.3 Management coordination : this task requires a dedicated secretary or animator with english skills.

Current projects running in CIAN

CIAN is based on 15 years of financed projects. For 5 years. The program has grown and today more than 12 projects are running. It thus requires a federation of coordination and communication.
These projects, all running at UTLN, are (non exhaustive list):

Generic

A) The Chair IA ADSIL at UTLN (2021-2024) will benefit from the start of CIAN. CIAN will allow us to maintain and reinforce the know-how in AI and machine listening of biodiversity.

B) EquipEx PIA3 TERRA-FORMA will benefit from advances in scientific instrumentation and AI for machine listening from CIAN, 2021-2030EquipEx PIA3 GAIA DATA: CIAN as TERRAFORMA will be a study case for GAIDATA.

C) PIA4 PSIBIOM 2021-2025 benefits from CIAN, with Terroiko and SI consult SAS.

Terrestrial monitoring

D) Canadian biodiversity large scale monitoring, 2016-2026, the largest survey of birds and insects in the world, from arctic to St-Laurent, since 2016, and processed by AI of Dyni LIS UTLN

E) ANR project ULPCOCHLEA, 2022-2026, evaluated A+ at the first round by ANR, for 4 years. They will develop complementary systems other than CIAN. CIAN will benefit from these projects and will extend at international scale their innovations for advanced bioacoustics in many parks around the globe.

F) ANR SYLVANIA evaluated A+ at the first round of ANR, 2022-2026, on advanced embedded AI and smart passive acoustic arrays to monitor invasive species or endangered species and phytosanitary treatment effects on insects.

G) UltraBees, with Greece and CNRS, 2017-2025

H) PIA4 Tropical forest monitoring, Green Praxis, LIS, Smiot, 2021-2026

I) Fukushima project, 2017-2027, to monitor birds and insects in Fukushima radioactive area and correlate and to model fauna behavior and population displacement according to uS modulation (in official convention Tokyo and Toulon universities. signed in 2017 in Toulon, Glotin Koyabashi).

J) European project BIODIVERSA TABMON, 2024 2028, with Niva No, Naturalis Netherland, Spain and Portugal, LIS, to monitor bird migration from arctic to Portugal.

Marine monitoring

K) European project BIODIVERSA EUROPAM, 2023 2027, with Pavia Univ, LIS, Ackvaplan SAS, IMAR Açores, to monitor whale migration and communication from Norwegian arctic to MedSea, via Acores.

L) FEDER Maritimo SeaStMar, 2024 2027, MIO, LIS, CIMA It., the continuation of GIAS Feder, to avoid whale-traffic collision including Bioacoustics and Bombyx system.

M) WhaleWay to monitor and interpret superpredators in Med sea, L181 and LIS, 2022-2027.

N) Souffle de Vie, with Live Together and CIAN, a cycle of missions in Med Sea and of movies in Monaco TV towards cetaceans and conservation, 2021-2027.

O) Mobydic, to monitor and model Physeter communication, L181 and LIS, Sorbonne Univ, 2011-2025, in Indian Ocean and elsewhere

P) Orca communication monitoring with ORCALAB, Vancouver, CA, 2015-2030.

Q) Patagonian passive acoustic monitoring with Dyni team expedition in Chili, 2017-2026, in collaboration with Valdivia and Concepcion Univ. (Bioacoustical summer schools in South america cycles are running with CIAN's coll. J. Patris and F. Malige).

R) ADAPREDAT, a pilot study of CIAN of the Interdisciplinary Mission of CNRS, towards the inter-specific vocal interactions in arctic fjord. Our missions in 2021, 22, 23 demonstrated very active vocal behavior of 4 voicing super-predators at the same time, at the same place.

S) CARIMAM+ : the continuation of CARIMAM with ONG's and AGOA national park in Carabeans to study a long series of cetacean acoustic presence over 20 stations (12 nations) that AGOA installed and processed with CIAN from 2019 to 2021, 2023 to 2025.

T) CPER Blue Innove de UTLN, deep sea monitoring, bioacoustic chapter, 2023-2026

U) MITI WedExt 'conditions extrême', Orsay, UTLN, IM2NP, LiS, MNHN, 2024-2026

V) Anthropophony group, ministry Ecology, 2019-2030

W) Polynesian Whale survey, 2024-2026

X) HYDROPHIN DEMOGE MARBEC LIS IFREMER, 2020-2025, monitoring fisheries/dolphin lethal interactions in Gascogne Golf

Y) Sphyrna Odyssée BIOSSA PURE Ocean

Z) Port Cros and Cap Corse parks, Maures Reserve, Pelagos sanctuary, ZMPV SSA

Permanent Observatories

LPSM) The LPSM CPPM interdisciplinary observatory in Toulon, continuation of Antares and KM3Env 2017-2030

PP) The Polar Pod 2025-2030, circumpolar mission headed by Dr Jean-Louis Etienne

OL) Orcalab, Vancouver CA

BX) Bombyx sonobuoy observatories in Med, Atlantic, Arctic, Antilles and Polynesia

VB) Valhallab observatories in Arctic and Mexico

PO) French Polynesian observatory

Arts&Sciences

AS) Arts&Sciences and large audience diffusion with Maxence Mercier Compositor
MA) Mangrove Production with CIAN for the UNOC https://www.mangroovemusic.org/actu/mangroove-music-est-a-agir-pour-le-vivant
TL) Museum exhibition Toulon MNHN 2023-2024
SA) Maison de la Mer Sanary permanent exhibition 2025-2035

Composition of CIAN

The task number refer to the section Tasks, the project label to the section current projects

Partners (~120)	Lab., Gov. or ONG	related Task(s)	Project(s) with UTLN	# man month/ year
Researchers in Toulon (48)				
Frédéric Schneider, MCF	CERC	6-9	K,L,V	2
Hervé Glotin, Pr	LIS, IUF	1-9	all	12
Valentin Gies, Pr	IM2NP	1-4,7-9	B,F,M,O,Q,R,S,U,V,Z,BX	6
Vincent Hugel, Pr	COSMER	1,4,7-9	T	1
Yann Ourmières, HDR	MIO	2,5,7,8	L,M,V	1
Hervé Barthélémy, Pr	IM2NP	1,4,7-8	B,F	1
Ricard Marxer, Pr	LIS	2,3,7,8	J,V,Z	4
Sébastien Paris, MCF	LIS	2,3,7,8	A,B,E,F,I,K,L,P,R,S,V	6
Adeline Paiement, HDR	LIS	2,3,7,8	A,B,E,K,N	4
Joseph Razik, MCF	LIS	3,4,7	A,R	1
Pascale Giraudet, Dr	LIS	2,3,5,7,8	A,B,E,M,O,R,V	3
Thierry Soriano, Pr	COSMER	1,3,4,7	T	1
Cédric Anthierens, MCF	COSMER	1,3,4,7	T	1
Mathieu Richier, MCF	COSMER	1,3,4,7	T	1
Claire Dune, HDR	COSMER	1,3,4,7	T	1
Valentin Barchasz, IGR	IM2NP	1,3,5,7	B,C,F,M,O,R,S,U,V,Z	10
Julien Seinturier, MCF	LIS	1,2,3,4,7	T	1
Laurent-Stéphane Didier, Pr	IMath	1,3,4,7	E	1
Reza Pakzad, Pr	IMath	3,7	K,L,M,R,V	2
David Reymond, MCF, HDR	IMSIC	2,6,7,8	B,Y	2
Jean-Marc Robert, MCF	IMath	1,3,4,7	E	1
Christophe de Luigi, MCF	MIO	2,3,5,6,7	Y	4
Jean-Marc Prévot, IGR	DSIUN, LIS	1,2,3,4	M,N,P,R,V,Z	4
Sébastien Boutellier, IGE	DSIUN, LIS	1,3,4	M,N,P,R,V,Z	3
Nathalie d'Alvise Prévot,MCF	MIO	2,5,7,8	R,Z	3

Franck Malige, R. Assoc	LIS	1,2,3,5,7,8	A,E,F,K,L,Q,V,Z	6
Nicolas Boizot, MCF HDR	LIS	1,2,3,7,8	M,R,T,V	1
Eric Busvelle, Pr	LIS	1,2,3,5,7,8	M,R,T,V	1
Loïc Lehnhoff, doctorant	MARBEC, LIS	2,3,5	X	12
Lara Berkenbaum, doctorante	LIS, R.Alembert, Sorbonne	2,5	O	12
Nicolas Deloustal, doctorant	LIS	2,3,5,7	N,M,P,R	12
Adrien Eve, doctorant	IM2NP, LIS	1,2,4	A,C,B,E,F,Z	12
Justine Girardet, doctorante	Univ Pavia & LIS	2,5,6	K,L,M,O,R,V	12
Gaetan Patenotre, doctorant (IGE,insc. sept 2024)	LIS, IMATH	2,3,5,6	A,E,K,L,M,R,V,Z	12
Stéphane Chavin, doctorant (insc. en cours)	LIS, MIO	2,3,5,6	D,I,K,L,M,S	12
Sara Erler, doctorante CIFRE	LIS, FDV Marine	2,5,6,8	Y	12
Anaelle Boué, doctorante	CERC	5,6,8	V	2
Philemon Prévot, IGE	LIS	1,2,3	A,E,F,L,M	12
Lisa Ferré, IGE	LIS	2,3,5	A,E,K,M,T,V,Z	12
Tristan Villepreux, IGR	LIS	1,2,3,4	A B,C,E,D,I,K,L,S,T	12
Paul Best, postdoc	LIS, ICLB	1-5	A,P,V,Y,Z	12
Sebastian Marzetti, postdoc	IM2NP	1-4	B,F,M,O,Q,R,S,U,V,Z	12
Post-doc ADSIL ANR	LIS	1-5	A	12
Post-doc ANR SYLVANIA	LIS	1-5	F	12
Post-doc ULPCOCHLEA ANR	LIS	1,2,3,5,8	E	12
1 IR/doct. SeaSteMar FEDER	MIO LIS	2,3,4,5,6,8	L	6
1 IR Tabmon Biodiversa	LIS	2,3,4,5,6,8	J	12
External partners, academics or national inst. in France (29)				
Stéphane Mallat, Pr	Collège de France	3,4,5,7	A,E,K,P	1
Julie Patris, MCF	AMU, LIS	1,2,3,4,6,7	A,E,F,K,Q	12
Bastien Mérigot, MCF	U. Montpellier, CNRS MARBEC	2,4,5,6,7	V,X	4
Mark Asch, Pr	U. J. Verne, CNRS LAMFA	3,4,6,7	A,K,L,R,T,V	4
Thierry Lengagne, CR, HDR	CNRS LEHNA, Lyon	2,3,4,5,6,7	F,Z	3
Romain Garrouste, CR, HDR	MNHN, Paris	2,3,5,6,7	F,Z	2
Paul Cristini, CR, HDR	CNRS LMA, Marseille	3,4,6,7	A,V	1
Olivier Adam, Pr	CNRS J.R.A, U. Sorbonne	3,4,5,6,7	O,V	4
Frédéric Sèbe, MCF	ENES, St Etienne, OFB	2,3,4,5,6,7	L,Z	4
Nicolas Mathevon, Pr	IUF,CNRS,INSERM, StEtienne	1-8	D,V,Z	6
Amandine Gasc, CR	IRD, IMBE, Aix-en-Pvce	2,4,5,6,7	B,Z	2
Isabelle Charrier, DR	CNRS, CNPS, Orsay	2,5,6,7,8	U,V	4
Vincent Bertin, DR	CNRS CPPM, AMU	1,2,3,4,5	K,L,V,Z	1
Pascal Coyle, DR	CNRS CPPM, AMU	1,2,3,4,5	K,L,V,Z	1
Nicolas Tomasini, Ms	OFB, Parc Cap Corse	2,3,5,6,7	V,Z	2
Bazile Kinda, Dr	SHOM	2,3,5,6,7	V,Z	1

Sylvain-Pierre Galliano, IGR	DGA, Toulon	1,2,3,4,5,6	A,K,L,R,V,Z	1
Mickael Dijoux, IGR	DGA, Toulon	1,2,3,4,5,6	A,K,L,R,V,Z	1
Odile Gerard, Dr	DGA, Toulon	1,2,3,4,5,6	A,K,L,R,V,Z	1
Stéphane Jespers, Dir réserv.	DGA TN, Paris	1,2,3,4,5,6	A,K,L,R,V,Z	3
Alexandra Gigou, IR	OFB PNPC	2,5,6,8	K,V,Z	1
Alexandre Villers	OFB	2,5,6	F,D,Z	1
Alain Barcelo, Dr	OFB	2,5,6,8	K,V,Z	3
Serge Planes, Dr	CNRS, CRIOBE, Perpignan	2,5,6	V,W	3
Laurent Longuevergne, Dr	UMR CNRS 6118, Rennes	1,2,4,5,6,8	B	1
Arnauld Leger, PR	LEFE, Montpellier	1,2,5,6,7	B,C	1
Maxime Cauchoix, Chaire Pr	RISE, SETE, Moulis	1-5, 8	B,C	4
Gérard Arnold, Dr	CNRS, Saclay	2,5,6,8	G,Z	2
International labs (17)				
Cláudia Oliveira, Dr	IMAR, Univ. of Azores	2,5,6,7	K,V,Z	4
Christine O'Sullivan, Dr	Univ. of Jamaica	2,5,8	S	2
Susanna Bucchan, MCF	Univ. de Concepción, Chile	2,5,8	Q	2
Renata Sousa-Lima, Pr	U. Fed. Rio Gde Norte, BR	2,3,5,6,7,8	V,Y,Z	4
Hill Kobayashi, Dr	Univ Tokyo, Japan	1-8	I,Z	3
Daisuke Shimotoku, Ing. R	Univ Tokyo, Japan	1-5	I,Z	3
Elena Schall, Dr	AWI, Germany	2,5,6	R,V	2
Sarah Manuel, IG	Dpt Env. Nat. Res., Bermuda	2,5,8	S,V	4
Alexandros Papachristoforou, Dr	APISLAB, Thessalis U., GR	2,5,7,8	F,G,Z	3
Agnese Marchini, Pr	Univ Pavia, Italy	2,3,5,6,7,8	K,L,V,Z	3
Claudio Fossat, Di	Univ Pavia, Italy	1,2,3,4	K,L,V,Z	3
Anouk Simard, Dr	Ministère des forêts, Canada	1,2,5,6,7	D,Z	6
Marie Roch, Pr	San Diego & Scripps, USA	1-8	R,V,Z	1
Dan Stowell, Assoc.Pr Pr	Tilburg univ., Netherlands	2,3,6	T	3
Industrials (18)				
Michel Manghi	Nauta, Italia	1,2,3,5	K,V,Z	2
Olivier Philippe, IGR	Osean SAS, Toulon, FR	1,2,3,5	K,L,T,V,Z, LPSM, PP	2
Franck Hiermente IGR	Osean SAS, Toulon, FR	1,2,3,5	K,L,T,V,Z	2
Fabien de Varenne, IGR	FBV Marine SAS, Laval,FR	1,2,3,5	A,Q,S,V,Y,Z	12
Martin Guillaume, IGR	Green Praxis, FR	1,2,3,5	H	2
Jérôme Di Giovanni, Dr	Green Praxis, FR	1,2,3,5	H	2
Claire Noël, Dr	SemanticTS, Toulon, FR	1,2,3,5	A,V	1
Philippe Cosentino, MS	CosPhylog, Toulon, FR	1,2,3,5	A,M,O,P,Y,AS	2
Maxence Mercier, doctorant	TripinLab, Lavandou, FR	1,2,3,5	AS	6
Stéphane Granzotto	S Granzotto, Lyon, FR	2,8	AS	2
Rodolphe Tanneau	Valhalla, Tromso, Norway	2,8	K,P,R,V	2
Pierre Priou, IR	Akvaplan, Norway	2-5	K,P,R,V	2

Katie S., IGR	Akvaplan, Norway	2-5	K,P,R,V	6
Lionel Camus, Dr	Akvaplan, Norway	2-8	K,P,R,V	1
ERDF	Energie renouv. éol. mer, FR	2-6	K,V,Z	1
Sandra Baksay, Dr	QAIR, Energie Marine, FR	2,5,6	K,V,Z	2
Anne Tessier, Dr	Marepolis, FR	2,5,6	K,V,Z	2
Francis Kurkdjian	Parfumeur, Paris, FR	2,5,8	M,O,AS	1
Institutions / Collectivities / ONG (12+)				
François Sarano, Dr	ONG Longitude 181, FR	2,5,6,8	K,L,M,O,R,V,Y,Z	10
Véronique Sarano, Dr	ONG Longitude 181, FR	2,5,6,8	K,L,M,O,R,V,Y,Z	10
Cathy Lacourbas	Guadeloupe, FR	2,5,8	S	3
Paul Psong Dr, Helena Symonds MS	OrcaLab, Vancouver,Canada	1,2,5,8	P,V	12
Massimiliano Rosso,Dr	CIMA, Italy	2,5,8	K,L,M,V,Z	2
Jean-Charles Vignals	Live Together, Monaco	2,5,8	N,V,Z	1
Philippe de Mondielli	Fondation Prince Albert II, Monaco	2,5,8	V,Y,Z,AS	1
S. Viera, MS	ONG Sphyrna Odyssey, FR	2,5,6,8	S,Y,Z	12
Julie Guiderdoni	Valhallab, Norway	2,5,8	P,R,V,AS	3
Sybille Bernard, Dir	ONG Domaine du Rayol,FR	2,5,6,8	F,K,L,V,Z,AS	1
Costanza Favilli	PELAGOS, FR IT MO	2,5,6,8	F,K,L,V,Z,AS	6
Jean-Louis Etienne, Dr	Polar Pod ONG, FR	2,5,6,8	F,K,L,V,Z,AS	2

Selected Publications from partners

Selected publications from UTLN CIAN partners (2019-2023)

Invention / Patent

Paris S., Glotin H. (2024) ” SeGaMaS, un serious game pour l’apprentissage conjoint de la détection classification et localisation des mammifères marins”, Déclaration d’invention, UTLN SATTSE

International challenge

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Articles in internat. journals

Poupard M., Best P., Pavan G., Glotin H, Vocal repertoire and bioacoustics analyses in Globicephala melas (long-finned pilot whale) from Mediterranean Sea, in submission, march (2023)

Ferrari M, Trinh-Hafner M , Sarano F., Sarano V, Giraudet P., Glotin H., (2023), Age and interpulse interval relation from newborn to adult sperm whale (Physeter macrocephalus) off Mauritius accepted, to appear in Scientific Report, Nature Springer Ed.

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Lehnhoff L., Glotin H., Bernard S., Dabin W., le Gall Y. et al. (2022). Behavioural Responses of Common Dolphins Delphinus delphis to a Bio-Inspired Acoustic Device for Limiting Fishery By-Catch. Sustainability. https://hal.umontpellier.fr/hal-03820889/document

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Malige F., Patris J., Hauray M., Giraudet P., Glotin H., et al.. Mathematical models of long term evolution of blue whale song types’ frequencies. Journal of Theoretical Biology, Elsevier, (2022), 548, pp.111184. https://hal.archives-ouvertes.fr/hal-03632687v2/document

Best, P., Marxer R., Paris S. and Glotin H. Temporal evolution of the Mediterranean fin whale song. Scientific reports, (2022) https://doi.org/10.1038/s41598-022-15379-0

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Sarano, Girardet, Sarano, Vitry, Preud’homme, Heuzey, Garcia-Cegarra, Madon, Delfour, Glotin, Adam, Jung, (2021), Kin relationships in cultural species of the marine realm: case study of a matrilineal social group of sperm whales off Mauritius island, Indian Ocean, Royal Society Open Science 8:201794. https://doi.org/10.1098/rsos.201794

Poupard M., Symonds H., Spong P., Glotin H. (2021) Intra-Group Orca Call Rate Modulation Estimation Using Compact Four Hydrophones Array. Frontiers in Marine Science https://doi.org/10.3389/fmars.2021.681036

Marie A. Roch, Scott Lindeneau, Gurisht Singh Aurora, Kaitlin E. Frasier, John A. Hildebrand, Glotin H., and Simone Baumann-Pickering , “Using context to train time-domain echolocation click detectors”, The Journal of the Acoustical Society of America 149, 3301-3310 (2021) https://asa.scitation.org/doi/pdf/10.1121/10.0004992

Best P., Marzetti S., Poupard M., Ferrari M., Paris S., Marxer R., Philippe O., Gies V., Barchasz V.,, 3 Glotin H. (2020) Stereo to five channels Bombyx sonobuoys : from four years cetacean monitoring to real-time whale ship anti-collision system. Eu. Forum Acusticum
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Barchasz V., Gies V., Marzetti S., Glotin H. (2020) A novel low-power high speed accurate and precise DAQ with embedded artificial intelligence for long term biodiversity survey, Eu. Forum Acusticum https://hal.archives-ouvertes.fr/FA2020/hal-03230835v1

Best P., Ferrari M., Poupard M., Paris S., Marxer R., Symonds H., Glotin H. (2020) Deep Learning and Domain Transfer for Orca Vocalization Detection. In International joint conference on neural networks. IEEE IJCNN, International joint conference on neural networks, Jul 2020, Glasgow, https://hal.archives-ouvertes.fr/hal-02865300/document

Balestriero R. and Glotin, H. and Baraniuk, R.G (2020) Interpretable Super-Resolution via a Learned Time-Series Representation, arxiv https://arxiv.org/pdf/2006.07713.pdf

Ferrari M., Glotin H., Marxer R., Asch (2020) End to end raw audio deep learning of transients, application to bioacoustics, Eu. Forum Acusticum
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Ferrari M. et al. (2020) 3D diarization of a sperm whale click cocktail party by an ultra high sampling rate portable hydrophone array for assessing individual cetacean growth curves, Eu. Forum Acusticum https://hal.archives-ouvertes.fr/hal-03078655/document

Ferrari M. et al. (2020) DOCC10: Open access dataset of marine mammal transient studies and end-to-end CNN classification, in 2020 International Joint Conference on Neural Networks (IJCNN). IEEE https://hal.archives-ouvertes.fr/hal-02866091/document

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Marzetti S., Gies V., Barchasz V., Barthelemy H., Glotin H., Kussener E., et al. (2020) Embedded Learning for Smart Functional Electrical Stimulation, IEEE Instrumentation & Measurement Technology Conf. (I2MTC) https://hal.archives-ouvertes.fr/hal-03386618/file/ITMS-2019-TENS_Learning.pdf

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Poupard M., Ferrari M., Schlüter J., Marxer R., Giraudet P., Barchasz V., Giès V., Pavan G., Glotin H., (2019) Real-time 3D passive acoustic tracking of cetacean by five non uniform aperture hydrophones mounted under autonomous surface vehicles. Proc. ICASSP 2019.

Balestriero, R Cosentino, H Glotin, R Baraniuk, (2018) Spline filters for end-to-end deep learning, International conference on machine learning, 364-373

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Ferrari, Glotin, Marxer, Asch, (2020), Docc10: Open access dataset of marine mammal transient studies and end-to-end Convolutional Neural Net classification, IJC Neural Net, https://hal.archives-ouvertes.fr/hal-02866091/document

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Laranjeira, M., Dune, C. and Hugel V. (2018), Local Vision-Based Tether Control for a Line of Underwater Robots. IEEE Int. Conf. on Intelligent Robots (IROS) workshop.

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A1) Lettre de soutien

Parc national de Port-Cros

M. Xavier LEROUX
Président de l'Université de Toulon
CS 60584
83041 TOULON CEDEX 1

Objet
Lettre de soutien au projet CIAN

Suivi par
Alexandra GIGOU
secretariat-connaissance-partrimoine@portcros-parcnational.fr
Réf . : MD/AB/4897

Date
A Hyères, le 13/03/2024

Monsieur le Président,

Le projet de centre CIAN de l'Université de Toulon est une opportunité de reconnaissance et de promotion internationales des compétences et de l'expertise du territoire et spécifiquement de l'UTLN dans les sciences de la mesure et de l'analyse des données acoustiques et les disciplines connexes. Il est la suite du projet ICOB déjà présenté aux instances et au PNPC en 2021-2022. Depuis il a conforté son rayonnement au niveau international.

Ce centre rassemble par ses projets actifs depuis plusieurs années (thèses, FEDER, ANR, etc.) plusieurs laboratoires qui interagissent aussi avec le PNPC au travers de ses activités de recherche : 3 UMR CNRS de l'UTLN cotuelle AMU (IM2NP, LIS, MIO), et plusieurs EA UTLN (COSMER, IMATH, BABEL, le Centre d'études et de recherche sur les contentieux -CERC-, etc.).

CIAN concerne non seulement l'acquisition de connaissances sur l'environnement marin et terrestre, les pressions qui s'y exercent, leur évolution et leurs impacts à court-moyen et long termes sur les socioécosystèmes et les cycles biologiques. Les développements en synergie de l'intelligence artificielle et de l'électronique associée dédiés à la surveillance de la biodiversité est rare, et après plusieurs années, toujours en avance de l'état de l'art à UTLN. C'est une position que le PNPC souhaite soutenir, entretenir et valoriser par sa collaboration au travers de ses appels à projets recherche notamment.

En effet, ces nouvelles technologies sont en mesure de répondre aux besoins de dispositifs de veille et d'alerte en faveur de la conservation de l'environnement mais également des biens et personnes.

Les objectifs de CIAN sont et seront encore atteints en déployant et mutualisant les connaissances du consortium (international), en promouvant la recherche mais également en proposant un volet formation, école d'été et colloques comme les anime déjà CIAN.

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Parc national de Port-Cros

Dans la continuité du soutien plein et entier du Parc national de Port-Cros, et de l'équipe d'animation de la partie française du Sanctuaire Pelagos, aux différents projets portés par l'UTLN via CIAN, qui répondent à nos besoins scientifiques et de gestion, nous serons ravis de participer au déploiement de ce nouveau centre et à sa réussite. CIAN est en effet différenciant au niveau régional, national et international, et participe à l'identité de Parc national 'laboratoire' innovant qu'est le PNPC.

L'équipe du service Connaissance pour la gestion de la biodiversité contribuera au titre du PNPC et identifiera les actions que le Parc national pourra valoriser au sein de CIAN.

Je vous prie d'agréer, Monsieur le Président, l'expression de mes salutations distinguées.

Le Directeur du Parc national de Port-Cros

M. Marc Duncombe

Par Délégation
Le Secrétaire Général
P.LARDE

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Ministère des Forêts,
de la Faune
et des Parcs
Québec
Service de la conservation de la biodiversité et des milieux humides

Le 12 mars 2024

Université de Toulon,
CS 60584 – 83041 Toulon,
CEDEX 9

Objet : Support pour la création d'un Centre international d'Intelligence Artificielle en Acoustique Naturelle

Monsieur le président de l'Université de Toulon,

Nous avons entrepris une collaboration avec le Laboratoire d'Hervé Glotin depuis 2019 afin d'améliorer les modèles de détection des espèces présentes dans nos enregistrements acoustiques réalisés en milieu forestier et humide à la grandeur du Québec. Leur expertise est grandement appréciée et depuis 2 ans nous sommes parvenues à des modèles très encourageants.

Le réseau de suivi de Biodiversité est un projet du Gouvernement du Québec qui mise sur la détection des changements dans les communautés d'espèces à l'aide de plusieurs indicateurs (Inventaires Terrain - Biodiversité Québec (biodiversite-quebec.ca). Les enregistrements acoustiques sont un indice phare qui vise la détection des oiseaux, mammifères, insectes chanteurs et anoures. Si une partie des identifications se font à l'oreille, miser sur une méthode par intelligence artificielle est un impondérable afin de réduire les coûts futurs et d'augmenter notre efficacité.

Le projet de **Centre international d'Intelligence Artificielle en Acoustique Naturelle** (CIAN) de l'Université de Toulon est très cohérent vis-à-vis nos activités et la collaboration entamée depuis plusieurs années. Je soutiens donc la politique de l'Université de Toulon de consacrer ce centre pour un affichage institutionnel de telles recherches et applications qui ont un impact au niveau international.

Veuillez agréer, Monsieur, l'expression de mes sentiments les meilleurs.

Anouk Simard
Biologiste PhD
Direction des espèces fauniques menacées ou vulnérables
Direction générale des écosystèmes et des espèces menacées ou vulnérables
Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs
880, chemin Sainte-Foy, 2.40
Québec (Québec) G1S 4X4
Téléphone : 418-627-8694, poste 707383
anouk.simard@mffp.gouv.qc.ca

Natal, Brazil - March 13th, 2024

To whom it may concern

I, Renata S. Sousa-Lima, PhD, director of the Laboratory of Bioacoustics and EcoAcoustic Research Hub (EAR Hub), at the Universidade Federal do Rio Grande do Norte (UFRN), located in the city of Natal, Brazil, strongly support the officialisation at the University level of the International Center of AI in Natural Acoustics, CIAN.

We have collaborated with CIAN since 2017 on cetacean passive acoustic monitoring. Our joint effort has resulted in exchange of expertise and ideas that culminated in papers published and students PhD defenses.

We continue to be interested in developing academic and technological innovation with University of Toulon and the big data analyses provided by University of Toulon is sure to reveal yet new insights about the behavioral ecology of whales and dolphins providing scientific evidence for marine spatial planning and mitigation for the proposed expansion of offshore sustainable energy initiative worldwide.

Renata S. Sousa-Lima

LaB
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Laboratório de Bioacústica, Departamento de Fisiologia, Centro de Biociências
Universidade Federal do Rio Grande do Norte
Natal, RN - Brasil 59078-970

Laboratory of Applied Apiculture
Department of Animal Science, University of Thessaly, Greece

12 March 2024
Larissa, Greece

To whom it may concern

I, Dr. Alexandros Papachristoforou, director of the Laboratory of Applied Apiculture, University of Thessaly, Greece, strongly support the officialisation at the University level of the International Center of AI in Natural Acoustics, CIAN.

We collaborate with CIAN since 2017 on the largest honeybee hive monitoring over the world.

The protocols elaborated by University of Toulon and the massive data analyses provided by University of Toulon reveals new insight into Bees behaviour, communication, and opens new horizons on bee hives monitoring.

Alexandros Papachristoforou

Assistant Professor
Director of the Laboratory of Applied Apiculture
Department of Animal Science
University of Thessaly, Greece
Tel: +30 6934665696
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Address: Geopolis Larisa, 41334, Greece

GOVERNMENT OF BERMUDA
Ministry of Home Affairs

Department of Environment and Natural Resources

14 March 2024

Professor Hervé Glotin
Head of the Scaled Acoustic Biodiversity Research Group
Sciences de l'Information et des Systèmes Lab. (LSIS) - UMR CNRS 7296
University of Toulon
BP20132
83957 La Garde CEDEX
France

Dear Prof Glotin,

The Bermuda Department of Environment and Natural Resources was very grateful to be included in the Caribbean Marine Mammal's Preservation Network's (CARI'MAM) Passive Acoustic Monitoring (PAM) project because it is providing us with information about the cetaceans that inhabit the Bermuda Marine Mammal Sanctuary. While we know a fair amount about the humpback whales that pass through our waters we know little about the habits of less common cetaceans that are occasionally observed in the deep water around Bermuda. Our Department has the capacity to deploy the hydrophone to record the data but we do not have the expertise on our small island to analyse the acoustic recordings, so without your lab to analyze the data we would not be able to undertake such a project.

As the CARI'MAM PAM project has ended we are pleased that you are willing to continue collaborating with us as part of your new endeavor, the International Center of AI in Natural Acoustics" (CIAN). We are looking forward to receiving the updated sound card for the hydrophone that you will be sending us, and we are very appreciative that you will continue to process the acoustic recordings.

Sincerely,

Sarah Manuel

Sarah Manuel
Senior Marine Conservation Officer

Marine Conservation Section, Department of Environment and Natural Resources
17 North Shore Road, Hamilton Parish, FL04, Bermuda
Phone: (441) 299-2325

BAHAMAS MARINE MAMMAL RESEARCH ORGANISATION

... a Bahamian non-profit organization promoting conservation of marine mammals through research and education ...

9 February 2022

On behalf of the Bahamas Marine Mammal Research Organisation (BMMRO), I am pleased to support the proposal for an *International Centre of Bioacoustics*, led by Pr Herve Glotin and put forth by the University of Toulon in the context of the *4th Programme d'investissements d'avenir (PIA4).*

BMMRO are excited to part of this effort and look forward to signing a formal agreement detailing the collaboration. BMMRO has extensive bioacoustic data in areas where marine mammals are threatened by increasing ship noise. We are keen to be involved in structuring our bioacoustic datasets and our upcoming bioacoustic projects to best serve the conservation of marine mammals in the Bahamas.

Charlotte A Dunn
President, BMMRO

Subject: Letter of acceptance of the project ICoB (International Center of Bioacoustics), PI Hervé Glotin

Partner Institution: IMAR, Instituto do Mar, Non-profit private institution

Person authorized to legally represent this Institution:

Name: Mário Rui — Surname: Rilhó Pinho

Email: mario.rr.pinho@uac.pt — Title: President of IMAR

Address: IMAR, Instituto do Mar, Departamento de Oceanografia e Pescas, Rua Professor Doutor Frederico Machado, 4 9901-862 Horta, Portugal

Before legally committing the here above Institution, I hereby declare:

- to have reviewed the complete tender file (scientific document, including its addendum, and administrative and financial document) as submitted on the ANR site and the regulations relative to the allocation rules for granting the aids related to the call « EXCELLENCE SOUS TOUTES SES FORMES »;
- to undertake to negotiate and sign a consortium agreement (or equivalent) and mobilize all necessary means to finalize this document within the conditions and scheduled deadlines as provided by the regulations related to the here above-mentioned allocation rules for granting the aids;
- to undertake to mobilize necessary means for the project completion as described in the tender file, within the conditions and scheduled deadlines as provided by the regulations related to the here above-mentioned allocation rules for granting the aids;
- to undertake to comply with financial commitments as detailed in the administrative and financial document of the submitted tender file;
- to undertake to conduct the recruitments on a contract basis of necessary staff for the completion of the submitted proposal and in compliance with applicable laws and regulations in force; to make available to the recruited staff for the completion of the project all necessary working spaces for the achievement of their missions for the duration of the project;
- to undertake all obligations referred to in the ANR financing regulations, notably for Action global assessment purposes.

Date: **Signature and official stamp**

Assinado por : **MÁRIO RUI RILHÓ DE PINHO**
Num. de Identificação: 08039252
Data: 2022.02.14 15:56:35-01'00'

CHAVE MÓVEL

1/1

University of Technology, Jamaica

237 Old Hope Road, Kingston 6,
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Phone : (876) 927-1680-8.
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President (Actg.) : Professor Colin Gyles

February 10, 2021

Professor Xavier Leroux
President
University of Toulon

Dear Professor Leroux,

As a lecturer at the University of Technology, Jamaica I would like to express my support for the proposal for the development of an International Centre of Bioacoustics (ICoB). The use of bioacoustics can help increase the amount of information available on marine species and I believe that this initiative will greatly support its use. The amount of marine mammal research conducted in Jamaica is currently limited and I hope that this initiative will help to increase marine research in the region.

Sincerely,

Christine O'Sullivan (Ms.)
Senior Lecturer
University of Technology, Jamaica
237 Old Hope Road,
Kingston 6

cc: Prof. H. Glotin, Director of the International Centre of Bioacoustics

LONGITUDE 181
La Voix de l'Océan

www.longitude181.org

M. le Président de l'Université de Toulon

Valence, le 10 mars 2024

Lettre de soutien au
Centre d'Intelligence Artificielle en Acoustique Naturelle
dans le cadre du projet « Maritime Horizon 2030 »

En février 2022, le premier grand rendez-vous mondial consacré aux océans, The One Ocean Summit, s'était achevé sur un constat sans équivoque : il faut renforcer la recherche et les pôles de compétences pour mieux connaître la faune et les écosystèmes menacés par les perturbations anthropiques. C'est le cas particulièrement aigu des cétacés de Méditerranée. Le projet de **Centre d'Intelligence Artificielle en Acoustique Naturelle** est une opportunité rare de répondre aux vœux de ce sommet, en rassemblant des compétences uniques en matière de technologies embarquées et de suivi acoustique des cétacés, au cœur même des écosystèmes sensibles à étudier, sur des agressions acoustiques dont on commence à mesurer les dramatiques effets.

Le prochain sommet mondial, UNOC 2025, organisé par la France, se tiendra à Nice en juin 2025. C'est une occasion unique de présenter les premiers résultats exceptionnels obtenus grâce au CIAAN, plus gros centre bioacoustique IA de France, ainsi que les propositions qui pourraient permettre de diminuer les agressions anthropiques sur les cétacés et sur l'ensemble des écosystèmes marins, en particulier en Méditerranée.

CIAAN est une chance unique, un moteur qui permet à de nombreux projets internationaux (Norvège, Île Maurice, Italie, Caraïbes) d'apporter des informations concrètes et solides sur les bureaux des décideurs, qu'ils soient internationaux ou nationaux ministériels.

L'association Longitude 181 souhaite marquer son immense intérêt au projet et apporter son soutien logistique sur le terrain dans la continuité des travaux menés en commun, depuis 8 ans, avec l'équipe du professeur H. Glotin pour une meilleure connaissance et protection des grands cétacés de la zone Pélagos et, plus largement, de Méditerranée.

LONGITUDE 181
La Voix de l'Océan
www.longitude181.org

Longitude 181 soutient la création du Centre d'Intelligence Artificielle en Acoustique Naturelle et souhaite développer, en tant que partenaire, un programme conjoint de suivi des cétacés, d'étude de leur communication sonore et de leurs structures sociales, notamment des cachalots, espèce reconnue « En Danger » en Méditerranée.

François Sarano
Docteur en Océanologie
Co-fondateur de Longitude 181
Directeur du programme cachalots

Véronique Sarano
Docteure en Océanologie
Co-fondatrice de Longitude 181
Coordinatrice du programme cachalots

université
PARIS-SACLAY

EVOLUTION GENOMES COMPORTEMENT ECOLOGIE EGCE

A qui de droit,

Je, soussigné Gérard Arnold, Directeur de recherche émérite au CNRS, soutiens fortement la reconnaissance par l'Université de Toulon de la qualité du travail scientifique réalisé en IA bioacoustique par le groupe dirigé par Hervé Glotin, en tant que centre universitaire d'IA pour la bioacoustique.

Je collabore avec le CIAN depuis 2017, et l'accumulation des nombreux enregistrements acoustiques réalisés sur des ruches, en Grèce comme en France, nous conduiront, dans les semaines à venir, à publier des articles scientifiques de haut niveau sur des aspects majeurs de la biologie des colonies abeilles, en relation avec les signaux acoustiques.

Dr Gérard ARNOLD

Directeur de recherche émérite au CNRS

Expert sur les abeilles à :

- l'European Food Safety Authority (EFSA) de 2012 à 2022

- l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail de 2016 à 2022

Prof. Nicolas MATHEVON

ENES Bioacoustics Research Laboratory
CRNL, Centre National de la Recherche Scientifique CNRS UMR 5292
Institut national de la santé et de la recherche médicale Inserm UMR_S 1028
23 rue Michelon, 42023 Saint-Etienne, FRANCE
mathevon@univ-st-etienne.fr

A qui de droit

Saint-Etienne, le 14 mars 2024.

Chers et chère collègues,

Au nom de mon équipe de recherche en bioacoustique (ENES Bioacoustics Research Lab), j'exprime ici notre plus vif soutien au projet de « Centre International d'IA en Acoustique Naturelle » CIAN. Dans un contexte mondial où la mise en œuvre de politiques de conservation des environnements terrestres et marins exige des approches scientifiques efficaces et économes, l'écoacoustique et la bioacoustique sont devenues des outils incontournables pour le suivi de la dynamique des écosystèmes dans leurs dynamiques temporelle et spatiale. La France occupe une place de choix dans ces disciplines. Plusieurs équipes de recherche de pointe y sont en effet présentes et CIAN représente une opportunité unique pour créer des synergies scientifiques et humaines visant l'excellence.

A l'université de Saint-Etienne, nous pilotons plusieurs formations dédiées à la bioacoustique et l'écoacoustique. Notre équipe de recherche ENES est une actrice majeure du domaine. Partageant largement nos objectifs scientifiques avec le Professeur Hervé Glotin, nos liens avec l'université de Toulon se resserrent tout naturellement. Nous serons donc ravis de participer, sous quelque forme que ce soit, à la maturation du projet CIAN.

Nicolas Mathevon

Nicolas Mathevon
Professeur de Classe Exceptionnelle, Université de Saint-Etienne
Membre Senior, Institut universitaire de France
Directeur d'Etudes, Ecole Pratique des Hautes Etudes
Membre, Academia Europaea
Directeur, ENES Bioacoustics Research lab

Soutien du LIS au projet UTLN de
Centre international d'intelligence artificielle en acoustique naturelle

Monsieur le Président de l'Université de Toulon,
Cher collègue,

Le Centre international d'intelligence artificielle en acoustique naturelle (ou CIAN) a vocation à structurer et animer la communauté scientifique internationale autour de l'interdisciplinarité entre informatique (et notamment le domaine de l'intelligence artificielle), robotique, sciences environnementales et sciences humaines au service de l'acoustique naturelle. Les recherches que le CIAN entend développer s'articulent autour d'une méthodologie unifiée visant à mieux comprendre les influences de facteurs anthropiques liés au son sur les bouleversements écologiques en cours (sur les écosystèmes, la biodiversité, etc.).

S'appuyant sur un terreau de recherches collaboratives locales, nationales et internationales particulièrement riche et fertile, ainsi que sur un ensemble de partenaires au premier plan de la scène internationale, mêlant des académiques, des industriels, des institutionnels et des ONG, le CIAN est selon moi un projet de centre de recherche parfaitement « armé » pour mener à bien les tâches et les missions qu'il met en exergue. Il est par ailleurs à ma connaissance et dans cette forme unique au monde au regard du sujet qu'il traite, l'acoustique naturelle, essentielle à la compréhension de l'impact de nos sociétés sur le monde.

Au delà des aspects purement scientifiques, passionnants et très prometteurs, le CIAN devrait permettre aux laboratoires qui le portent comme le LIS et à son établissement tutelle, l'Université de Toulon, de devenir les têtes de proue d'un domaine fondamental en plein essor, et donc de briller à l'international. Nous ne pouvons selon moi passer à côté d'une telle occasion.

Pour toutes ces raisons, au nom du LIS, je soutiens avec la plus grande force la création du Centre international d'intelligence artificielle en acoustique naturelle.

Je vous prie d'agréer, Monsieur le Président, l'expression de mes sincères salutations.

À Marseille, le 14 mars 2024

Sylvain SENÉ
Directeur du LIS
UMR 7020
AMU-CNRS-UTLN-ECM

CRIOBE
CENTRE DE RECHERCHES INSULAIRES ET OBSERVATOIRE DE L'ENVIRONNEMENT
UAR3278

March 14th, 2024

To Whom it may concern

I, Dr. Serge PLANES, research director at CNRS and base at the UAR 3278 CRIOBE, strongly support the officialisation at the University level of the International Center of AI in Natural Acoustics, CIAN.

We collaborate with CIAN and Dr. Hervé Glotin since 2019 on acoustic monitoring looking for marine mammals in the Mediterranean Sea.

The protocols elaborated by University of Toulon and the massive data analyses provided by University of Toulon have been essential in the projects we are collaborating.

Dr Serge PLANES

Serge PLANES | École Pratique des Hautes Études (EPHE)
CRIOBE UAR3278, Université de Perpignan Via Domitia, 58 Avenue Paul Alduy, 66860 Perpignan Cedex, France
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marbec
marine biodiversity exploitation & conservation
www.umr-marbec.fr

Dr. Bastien MERIGOT

Maître de Conférences HDR Université de Montpellier

UMR MARBEC - Station Ifremer, Avenue Jean Monnet, CS 30171
34203 Sète Cedex, France.
Téléphone : +334 99 57 61 30
Fax : +334 99 57 32 95.

A Sète, le 15 mars 2024

Au

Conseil Académique de l'Université de Toulon
Université de Toulon - CS 60584
83041 TOULON CEDEX 9

Objet : Collaborations entre l'Université de Toulon-UMR LIS et l'Université de Montpellier-UMR MARBEC au sein du CIAN.

Madame, Monsieur,

Par la présente lettre, j'atteste des collaborations scientifiques que nous avons établis depuis 2020 avec le Professeur Hervé Glotin et son équipe dans le cadre de trois projets de recherche (DOLPHINFREE, DELMOGES, HYDROPHIN), collaborations qui s'inscrivent au sein du Centre International d'IA en Acoustique Naturelle. Ces collaborations s'avèrent particulièrement fructueuses et se concrétisent notamment par la co-direction d'une thèse de doctorat en lien avec l'étho-acoustique des cétacés et l'IA dans un contexte socio-politique critique associé aux captures accidentelles par la pêche professionnelle d'espèces protégées. Cette problématique a conduit la Commission Européenne à mettre en demeure la France afin de trouver des solutions concrètes pour limiter ces captures.

Les collaborations que nous réalisons s'établissent pleinement et directement dans cette dynamique, et je soutiens donc pleinement la continuité du CIAN afin de poursuivre nos travaux communs dans les meilleures conditions possibles.

Je vous prie d'agréer, Madame, Monsieur, l'expression de mes salutations distinguées.

Dr. Bastien Mérigot

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IRD Institut de recherche pour le développement — Ifremer — cnrs

Mark Asch
LAMFA CNRS-UMR 7352
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URL: http ://www.lamfa.u-picardie.fr/asch

Mark Asch · LAMFA CNRS-UMR 7352 · Université de Picardie Jules Verne · 80039 Amiens FRANCE

Paris, 22 mars 2024

Lettre de soutien/Letter of support : CIAN

Je collabore avec Pr. Hervé Glotin et son équipe depuis 10 ans, où j'apporte de l'expertise et de l'encadrement en modélisation mathématique et statistique. Le projet CIAN nous permettrait de poursuivre nos projets communs, dont les résultats scientifiques sont d'un excellent niveau et font preuve d'une interdisciplinarité exemplaire. Je soutien donc pleinement le projet CIAN.

I have collaborated with Prof. Hervé Glotin and his team for the past 10 years, where I contribute expertise and thesis co-direction in mathematical and statistical modelling. The CIAN project will enable us to pursue our common projects, whose scientific results have been top level and are proof of an exemplary inredisciplinary approach. I therefore strongly support the CIAN project.

Sincerely,

Mark Asch, Professeur Emeritus

Sorbonne Université
Institut d'Alembert CNRS UMR 7190

Olivier Adam
Professeur des Universités
email: olivier.adam@sorbonne-universite.fr

Hervé GLOTIN
Professeur des Universités
UMR CNRS LIS
Université de Toulon

Paris, le 23 mars 2024

Objet : soutien au projet CIAN

A l'attention de Prof Hervé Glotin,

La collecte et l'analyse de données bioacoustiques relevant des études des cétacés et de leur milieu sont une partie importante et fondamentale pour la caractérisation du bon état écologique des océans et pour l'estimation des impacts des activités humaines en mer. De plus, les approches par intelligence artificielle sont actuellement à développer, à appliquer et à enseigner.

C'est donc sans réserve que je soutiens la création du Centre International d'IA en Acoustique Naturelle au sein de l'UTLN.

Cordialement,

Olivier ADAM

Sorbonne Université, Institut d'Alembert, 4 place Jussieu, 75252 Paris cedex 05, France
Tél : + 33 144 278 718 / *Fax* : +33 144 275 259 / *Email* : olivier.adam@sorbonne-universite.fr

O S E A N

T e c h n o l o g y

Dr. Frédéric GUINNETON,
Vice-président à la recherche à l'UTLN,

Pr. Hervé GLOTIN,
Professeur et chercheur à l'UTLN.

Object: Lettre de soutien à la candidature de l'Université de Toulon dans le cadre du projet ICoB – International Center of Bioacoustics pour l'appel à projet PIA4 "ExcellencES" de l'Agence Nationale de Recherche.

Déjà partenaire de l'Université de Toulon depuis plusieurs années dans le cadre du développement et de l'exploitation des instruments océanographiques Bombyx1 et Bombyx2, ce nouveau projet a retenu toute notre attention du fait de son intérêt scientifique et environnementale, mais aussi car il a pour objectif d'aboutir sur de nouveaux instruments innovants.

Dans la dynamique de la publication scientifique "(2022). Passive acoustic monitoring of sperm whales and anthropogenic noise using stereophonic recordings in the Mediterranean Sea, North West Pelagos Sanctuary. Scientific Reports. 12. 10.1038/s41598-022-05917-1.", nous souhaitons prolonger et renforcer les efforts de coopérations entre les activités de l'Université de Toulon et celles d'OSEAN.

Je soussigné Monsieur PHILIPPE Olivier, en ma qualité de président d'OSEAN SAS, m'engage à mettre en place toutes les dispositions nécessaires pour participer en tant qu'organisme partenaire à la proposition de Centre International de Bioacoustique ICoB soumise dans le cadre de l'appel "Excellence sous toutes ses formes" si la proposition est financée.

Je déclare par la présente que je suis habilité à engager dans ce processus l'entité que je représente.

Le Pradet, le 9 Février 2022

OSEAN S.A.S
ZAE LA BAYETTE
83220 LE PRADET - FRANCE
Siret : 451 128 755 00035
N° TVA INTRACOM : FR 82 451 128 755

Mr. Olivier PHILIPPE,
President/CEO

Rennes, February 6th, 2022

M. Hervé Glotin
Univ. de Toulon,
BP20132-
83957 La Garde CEDEX-France

Laurent Longuevergne
Laurent.longuevergne@univ-rennes1.fr

Objet : Support letter to the ICOB international bioaccoustic center

To whom it concerns
M. the president of Toulon University,

TERRA FORMA is a PIA3 EQUIPEX+ project aiming to design and test a smart observation platform of socio-ecological systems in the Anthropocene. This ambitious project gathers 42 national laboratories in an interdisciplinary effort at the crossroad of Earth, environmental, technological, computer and social sciences. The objective is to offer a new multi-messenger vision, coupling sensor viewpoints on human, biotic and abiotic dynamics. This project builds on pioneering and mature technological advances to design and probe a scalable network of smart sensors. Hervé Glotin and his team has been selected to design a new audio-video trapping system for continuous monitoring and automatic recognition of a wide range of animals and activities on the continents.

The International Center of Bioaccoustics (ICoB), proposed within the PIA4 ExcellencES program Maritim'Ho, is aiming to become a focal convergence point for the national and international community in Bioaccoustics, strengthening the recognized leadership of Toulon University in this domain. Bioacoustics is offering an unprecedented opportunity for the long-term monitoring and surveillance of natural and anthropized systems when designed around smart and low energy systems. The activities proposed by the ICoB are fundamentally aligned with the ambition to develop cutting edge research and teaching in environmental sciences.

The ICOB proposal consists of the development of a wide range of bioaccoustic tools and methods, which complements the specific sensor that is supported in TERRA FORMA project.

In the view of these elements s, TERRA FORMA strongly supports the ICOB project

Laurent Longuevergne

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

OFB
OFFICE FRANÇAIS DE LA BIODIVERSITÉ

AGOA
sanctuaire mammifères marins ANTILLES FRANÇAISES

Université de Toulon
CS 60584
83041 TOULON CEDEX 9

Sanctuaire Agoa / Office français de la biodiversité

Collaboration autour de l'observatoire acoustique international CARI'MAM

Les Trois Ilets, le 15 mars 2024

Madame, Monsieur,

De 2018 à 2021, le projet CARI'MAM (*Caribbean Marine Mammal Preservation Network*), financé par le programme Interreg Caraïbes a permis de créer un réseau d'acteurs engagés dans la recherche et la conservation des mammifères marins dans la Grande Région Caraïbe.

Au cours de ce projet, un observatoire acoustique a été développé en partenariat avec le laboratoire LYS de l'Université de Toulon. 17 hydrophones JASON HIGHBLUE ont été déployés dans 13 territoires de la Caraïbe pour améliorer les connaissances sur la distribution des cétacés dans la région.

Malgré la fin des financements européens il y a plus de 2 ans, 7 territoires continuent de déployer ces hydrophones à leurs propres frais en 2024 : Anguilla, les Bahamas, les Bermudes, Bonaire, la Guadeloupe, Saint-Martin et Saint-Eustache. A noter que de nouveaux territoires, à l'image d'Antigua, ont manifesté un intérêt pour intégrer ce réseau et déployer un hydrophone.

Le jeu de données constitué depuis 2020 est unique. Son enrichissement dans le temps va permettre des avancées scientifiques majeures dans la compréhension des comportements vocaux des baleines à bosse et dans la distribution des différentes espèces de dauphins dans la région, et ce grâce aux travaux d'analyse de CIAN utilisant des modèles de type réseaux neuronaux de pointe.

Dans la continuité du projet CARI'MAM, le Sanctuaire Agoa est l'interlocuteur privilégié de CIAN et son relai sur le terrain. Le Sanctuaire Agoa s'attache à entretenir le réseau de structures locales en coordonnant les efforts de déploiement, en fournissant une aide et une première assistance technique et en faisant le lien entre les données collectées et les résultats des analyses faites par l'Université de Toulon. A ce titre, le soutien des scientifiques et ingénieurs de CIAN pour la maintenance, l'instrumentation et le traitement des données est indispensable à la pérennité de cet observatoire.

Je suis à votre entière disposition pour tout renseignement complémentaire et vous prie d'agréer, Madame, Monsieur, l'expression de mes salutations distinguées.

Jérôme Couvat
Responsable scientifique du Sanctuaire Agoa

Sanctuaire Agoa
19 rue du Bel Air, Pointe Desgrottes
97229 Les Trois-Ilets
Sanctuaire.agoa@ofb.gouv.fr

A2) Example of diffusion : 50 000 visitors to CIAN exposition 2023

LE DÉPARTEMENT

DIRECTION DE LA CULTURE, DES SPORTS ET DE LA JEUNESSE

MUSÉUM DÉPARTEMENTAL DU VAR

Muséum départemental du Var
737 chemin du Jonquet,
Jardin départemental du Las,
83200 TOULON

A Toulon, le 08/02/2024

ATTESTATION DE COMMISSARIAT D'EXPOSITION POUR "PLONGÉE SONORE AVEC LES CÉTACÉS", AU SEIN DU MUSÉUM DÉPARTEMENTAL DU VAR

Madame, Monsieur,

Je soussignée, Andréa PARES, Conservatrice du Patrimoine et Responsable du Muséum départemental du Var, certifie que le commissariat scientifique de l'exposition « Plongée sonore avec les cétacés » a été assuré par **Pascale GIRAUDET et Hervé GLOTIN, de l'Université de Toulon et du laboratoire LIS**.

Le Muséum départemental du Var a invité les groupes, scolaires et les visiteurs individuels à un voyage hors du commun, en immersion dans les profondeurs abyssales de la mer Méditerranée du 14 avril 2023, avec prolongation jusqu'au 10 mars 2024.
L'exposition « Plongée sonore avec les cétacés » s'est focalisée sur les approches innovantes des analyses des sons sous-marins imperceptibles par l'oreille humaine et pourtant si caractéristiques de la vie océanique. Avec l'aide de Pascale Giraudet et de Hervé Glotin, chercheurs précurseurs de la bioacoustique de l'Université de Toulon, il s'agissait de faire découvrir les mystères du langage sonore des cétacés présents au large des côtes varoises.
L'objectif était de tendre l'oreille pour explorer les clics des cachalots, les sifflements des dauphins ou encore les chants des baleines afin de donner la parole aux moins audibles et certainement aux plus menacés des habitants de la mer Méditerranée. L'occasion de révéler l'importance de leurs rôles dans les écosystèmes marins présents aux portes du Var, dans un monde obscure et injustement qualifié de silencieux.

Sur les neuf premiers mois de l'exposition (année 2023), l'exposition a accueilli environ 47 000 visiteurs (soit une moyenne de 24 visiteurs par heure durant 9 mois), ce qui est un total bien supérieur à la moyenne, d'où la prolongation exceptionnelle de l'exposition pour quatre mois en 2024.

Toute l'équipe du Muséum départemental du Var se joint à moi pour remercier Pascale Giraudet et Hervé Glotin pour leur partage de savoir et soutien précieux tout au long de la création et de l'ouverture au public de cette passionnante exposition temporaire.

Pour faire valoir ce que de droit.

Pour le Président du Conseil départemental du Var et par délégation
Andréa PARÉS
Responsable du Muséum Départemental du Var
Direction de la culture, des sports et de la jeunesse
Département du Var
390, avenue des lices - CS 41303 - 83076 Toulon Cedex

A3) Article in Financial Times 2023 on our researches in Tropical Forest with Green Praxis

Moral Money Climate change

What does biodiversity sound like?

Also in today's newsletter, a new way to put money to work for good

A road cuts through palm plantations in Borneo. A pilot study has been carried out on a palm oil plantation in Borneo to measure animal biodiversity © Bloomberg

Simon Mundy and **Persis Love** JULY 19 2023

This article is an on-site version of our Moral Money newsletter. Sign up here to get the newsletter sent straight to your inbox.

Visit our Moral Money hub for all the latest ESG news, opinion and analysis from around the FT

Hello from London, which has — so far — been spared the brunt of the heatwaves sweeping much of the rest of the world in recent days. Wildfires are blazing from Canada to Greece. Temperatures hit 46°C in Sicily yesterday, while Phoenix, Arizona reached a record 19 consecutive days with temperatures above 110°F (43.3°C). We will have to wait to see the impact on death statistics, but research on previous heatwaves has made for grim reading.

While developing nations from Bangladesh to Ethiopia have long been painfully familiar with the brutal force of climate change, it's worth considering the effect on rich-world politics as climate impacts strike closer to home. Will this serve to galvanise ambition for a rapid energy transition, crackdowns on heavy emitters, and greater support for low-income nations that are most vulnerable? For business and finance, the implications could be profound.

That's a topic we'll continue to pursue in future editions. Today, the FT's Persis Love explores how investors could use the power of sound to track biodiversity risk. And I look at an effort to unlock a new wave of funds into impact investment. — *Simon Mundy*

Few parts of the financial sector have been more controversial than the private equity industry. Yet PE firms are now making serious efforts to position themselves as sustainability leaders. Is this a marketing ploy — or can this sector play a role in tackling the world's environmental and social challenges? That will be the focus of our next Moral Money Forum report, and we want to hear from our readers. Click here to fill out our short survey.

Investors look to bioacoustics as indicator of biodiversity levels

For companies seeking to measure their contribution to the climate crisis, the key metric to track is in most cases pretty clear: tonnes of carbon dioxide emissions linked to their operations. But when it comes to assessing their impact on biodiversity, measurement has proved much trickier.

French green tech company GreenPRAXIS hopes that bioacoustics — measuring the sounds produced by the natural world — could provide a solution.

"We're following the basic principle that you can't improve what you don't measure," their chief executive Martin Guillaume told me.

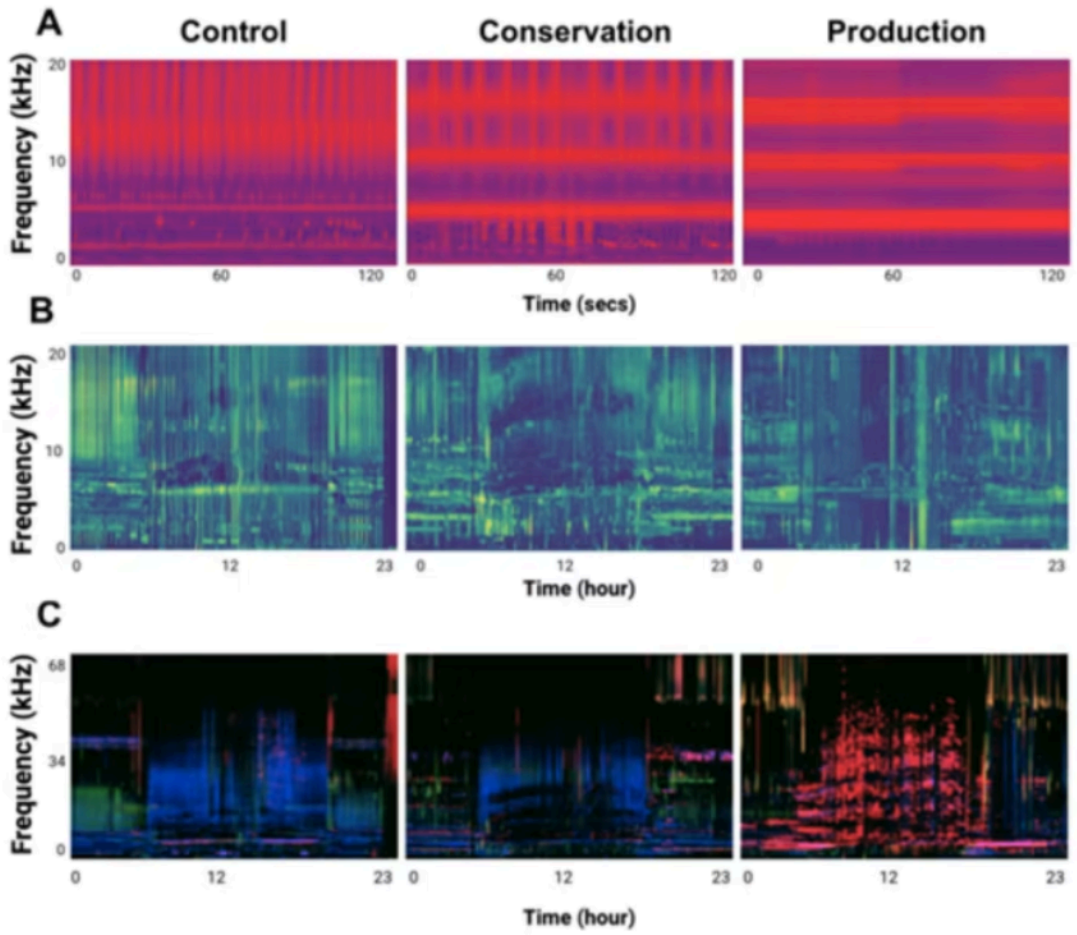
The natural world is noisier than many of us thought. Tomato plants pop when lacking water, unhatched turtles make noises from within their shells, healthy soil emits a cacophony of noise from worms and bugs, and coral larvae can hear the sound of their home reef from across the ocean.

GreenPRAXIS, which offers tech and data-led sustainable solutions for vegetation management, partnered with financial services companies Fidelity International, Cardano and Nomura to conduct a pilot study on a palm oil plantation in Borneo to measure animal biodiversity.

Greta Fearman, senior responsible investment officer at Cardano, said it was looking for "concrete evidence" of a company's impact. The current methods it uses to assess a company's commitment to biodiversity are mostly qualitative — based on the company's policies and targets. "I think biodiversity as an overarching concept is still abstract for a lot of companies," Fearman said.

The Borneo study yielded positive results. Researchers compared audio recordings taken on a working palm oil plot, a conservation plot that hadn't been farmed for decades, and a control plot of relatively untouched forest in the same region.

The recording from the working plot showed mainly insect noises, that from the conservation plot showed a much greater presence of birds too, and the audio from the control plot captured the sounds of primates such as gibbons and other creatures.



Spectrogram images from GreenPRAXIS's study in Borneo © GreenPRAXIS

Similar methods are being used by researchers to measure the success of biodiversity restoration projects on coral reefs. A second pilot is on the cards for later this year.

Jenn-Hui Tan, Fidelity International's head of stewardship and sustainable investing, said its asset managers had a responsibility to assess how environmental changes would impact businesses.

"The loss of biodiversity presents significant financial risks for the companies that we invest in in two ways," he told me. "One is around the dependency that businesses have on ecosystem services provided by natural capital" — you can't farm crops without a functioning ecosystem, for example.

The second relates to the impact of a company's activities on biodiversity. "There's an increasing raft of both regulation and also reputational risk associated with having an outsized impact [on biodiversity]."

But he emphasised that there wasn't one right way of measuring biodiversity. Alternatives include the Biodiversity Intactness Index, an indicator devised by the Natural History Museum that collates data from pre-existing ecological studies, and environmental DNA, which measures genetic traces left behind by plants and animals in water or soil.

GreenPRAXIS chief operating officer Jerome Di Giovanni said the strengths of the bioacoustics approach were that it is non-invasive, and that it can be deployed at speed. "If someone calls you and says 'hey, I need a diagnostic of biodiversity'. then they need it yesterday, not in six months," he said. *(Persis Love)*

A new way to put donor-advised funds to work

Over the past couple of decades, a once obscure financial structure has mushroomed into a massive part of the philanthropic landscape. It's called the donor-advised fund (DAF), and now accounts for one in every seven dollars of US charitable giving, and a fast-growing share in the UK.

When a (typically wealthy) donor transfers money into a DAF, they get to book a tax deduction immediately, as they would when donating to a public charity. But while the money in a DAF legally has to be passed on to charities, this can be done whenever the donor decides — so the money can sit in the fund, under the donor's effective control, indefinitely.

DAFs have been attacked by critics who say they are tying up money that would otherwise be available to charities. Assets in US DAFs reached $234bn in 2021, up 40 per cent year on year; payouts from DAFs to charities (or, in some cases, to other DAFs) rose at a slower pace of 28 per cent, to $46bn.

There's no immediate prospect of an end to this boom, after a bill to reform DAFs stalled in Congress last year. And the trend is picking up in the UK: contributions to DAFs reached £626mn in 2021, against total charitable giving of £10.7bn.

So, while all that cash sits in DAFs before (eventually, one hopes) being donated to charity, can it at least be put to good use?

That's the logic behind a new fund of funds being set up by Social Finance, an impact finance and advisory non-profit. At the moment, Social Finance's chief executive Tracy Palandjian told me, the cash in DAFs is commonly invested in money market funds or index trackers. Her organisation's new Impact First Fund aims to raise money from DAFs — and other investors — and in turn invest this cash with funds committed to positive social and environmental impact.

While a growing number of investors and philanthropists are attracted to the idea of impact investment, Palandjian says, many feel ill-equipped to choose from the large number of impact funds on the market. With its established record and existing partners including Google, she argues, Social Finance can offer them an effective means of deploying capital in the space.

The fund of funds will have its first close this summer, and is aiming to raise $100mn by the end of this year. It's already drawn up a shortlist of 20 funds for potential investment. One of these focuses on supporting the rollout of solar power in low-income areas; another invests in work to help communities vulnerable to climate impacts; a third is pursuing investments in sustainable agriculture.

Palandjian says the fund will pursue a "principal plus" strategy, aiming to deliver investors a return that more than keeps pace with inflation. Significantly, she's not seeking to convince them that this fund will match the financial returns they could make with a conventional investment portfolio.

As impact funds have proliferated in recent years — notably among some of the biggest private equity firms — some managers have been promoting a "have your cake and eat it" message, promising serious social impact without any compromise on financial returns. Palandjian argues that, if fund managers want to pursue serious impact, they'll need to take on "all kinds of risks that will not be compensated financially".

It's a pitch that may not appeal to all investors. But if the vast sums in DAFs are to be a permanent feature of the financial landscape, serious thought needs to go into what is done with that money while it sits there. *(Simon Mundy)*