Annual Report

2022

ETIS

Équipes Traitement
de l'Information
et Systèmes

cnrs

ENSEA

CY CERGY PARIS UNIVERSITÉ

EDITORIAL OF

Olivier ROMAIN

Director of ETIS

2022 WAS A SYMBOLIC YEAR

2022 is a symbolic year. Symbolic of a return to normal operating conditions after the various crises at COVID. Symbolic of the mid-term review of the contract with the installation of the Laboratory's Strategic Orientation Committee. Symbol of the increase in the laboratory's excellence, with the involvement of ETIS in two PEPR projects and the first CNRS CPJ – Chaire de Professeur Junior.

The year 2022 provided an opportunity to carry out a mid-term review of its project its project around intelligent and communicating systems, complementary issues around AI, security, health, IoT and new mobilities, before a committee of 5 experts covering the themes of the 4 teams and research group. To support the latter, the laboratory has included strategic and complementary actions in its 2020-2024 project. They concern the implementation of new tools to support: (i) the emergence of unit projects at the interfaces of the teams - Tremplin, (ii) the search for additional resources, (iii) the strengthening of human resources, and (iv) the international development of the laboratory, (v) developing excellence in research through national and international development projects, and (vi) increasing both scientific awards and distinctions. These actions have been amplified at the level of the management, the four research teams and design research group. This year has been punctuated by excellent results. Thus, our flagship fields have been supported by PEPR and PIA research projects (in particular PEPR 5G and PEPR Agro-écologie et Numérique), recognised by awards, nominations and high-impact publications, and promoted through highlights events, industrial projects (CIFRE), international collaborative projects (ANR PRCI) and research actions with the IRL IPAL. Finally, the laboratory's management wanted to step up its efforts to raise awareness of sustainable development issues and position the laboratory in this field. A new project manager has been appointed to lead our community on these issues.

These few extracts from the activity report are intended to arouse your curiosity. Please feel free to browse through this report, our website and our other communication channels to find out more.

This report is the fruit of all the members of the laboratory.
Thank you all for your continuous efforts.

Olivier ROMAIN
Director of ETIS

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ETIS 2022

ETIS // Équipes Traitement de l' Information et Systèmes
RAPPORT ANNUEL 2022

KPI

Key
Point
Indicator

Structure of the Lab

Direction and administrative	
	- *1 director (CYU)*
	- *1 deputy director (CYU)*
	- *4 administrative*
	- *5 projects managers*
	- *1 student club*
Teams and research groups	
	- *4 teams*
	- *1 new research group (sept 2021)*
Engineers group	
	- *9 engineers (including 5 CNRS)*

Staff (end of 2022)

160 peoples
68 permanents
66 PhD, ATER and Post-doc
26 Associates and others

2 IUF

68 Permanents
16 full Professors + 1 emeritus
37 assistant Professors
1 CR CNRS
1 CPJ CNRS
12 ITA

CNRS
11%

CYU
53%

ENSEA
36%
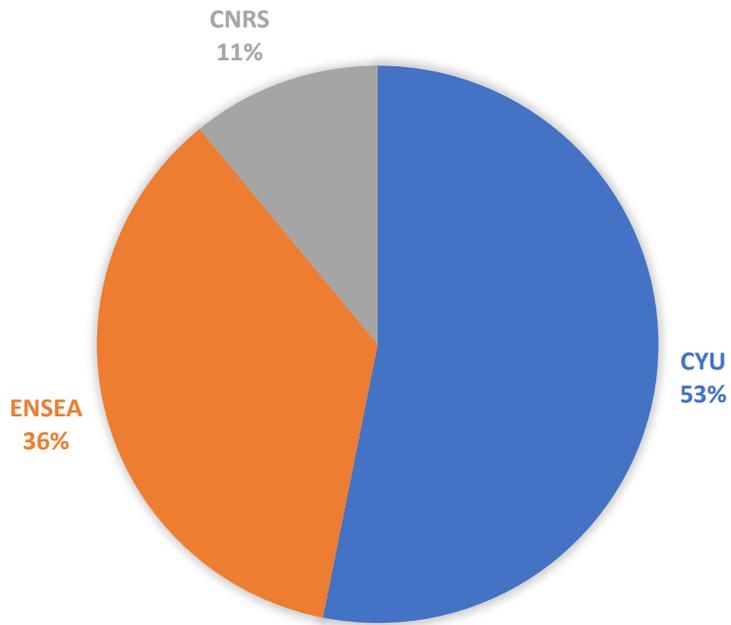
Average age 48 years

Gender parity
20 women – 31%
45 men – 69%

ITA
8%

PU
10%

Associated
12%

MCF
20%

CR CNRS
1%

ATER / post-
doc
8%

PHD
41%
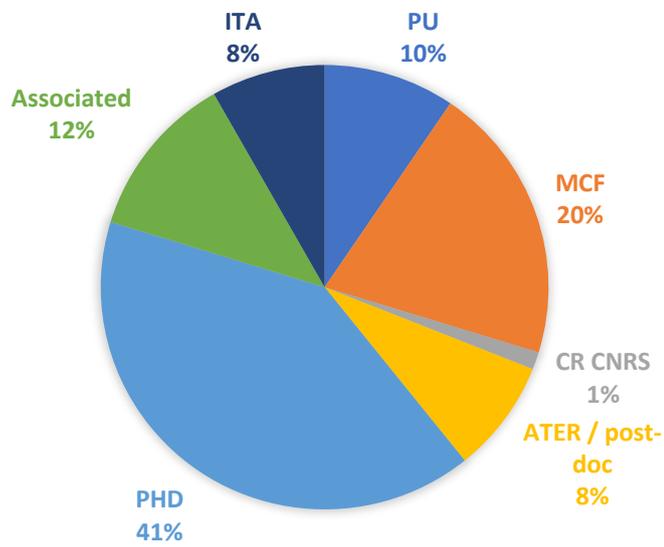
6 strategic domains
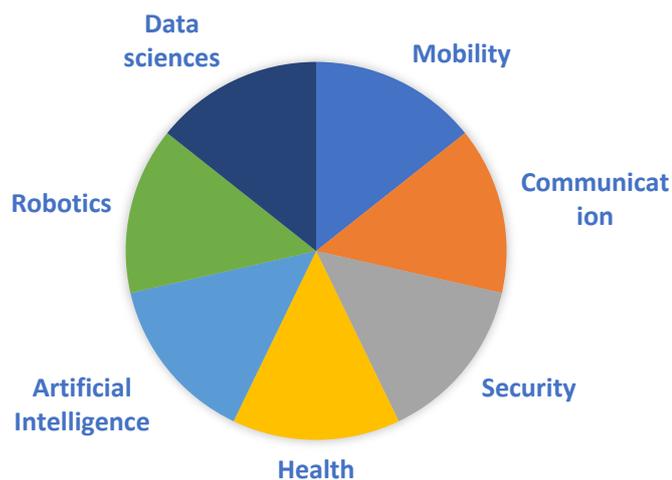
⼯ Publications

In 2022			From 2019 to 2022		
Journals	*Conferences*	*Total*	*Journals*	*Conferences*	*Total*
60	*77*	*193*	*205*	*257*	*634*

Between team
Journals	*Conferences*
5	*1*

Teams	Journals	Conferences	National conferences	Dissemination	Book	Chapters	Patents	Others
CELL	15	29	1	1	0	0	1	2
ICI	21	21	8	0	0	0	0	5
MIDI	16	16	4	7	0	2	0	2
NEURO	10	11	2	7	2	2	0	4
DESIGN	3	1	5	3	0	0	0	0
Between Team	5	1	1	1	0	0	0	0
ETIS	**60**	**77**	**19**	**17**	**2**	**4**	**1**	13

Publication in 2022

Legend: DESIGN, NEURO, MIDI, ICI, CELL

Categories (top to bottom): Others, Thesis, Patents, Book Chapters, Book, Dissemination, National conferences, Conference papers, Journal Papers
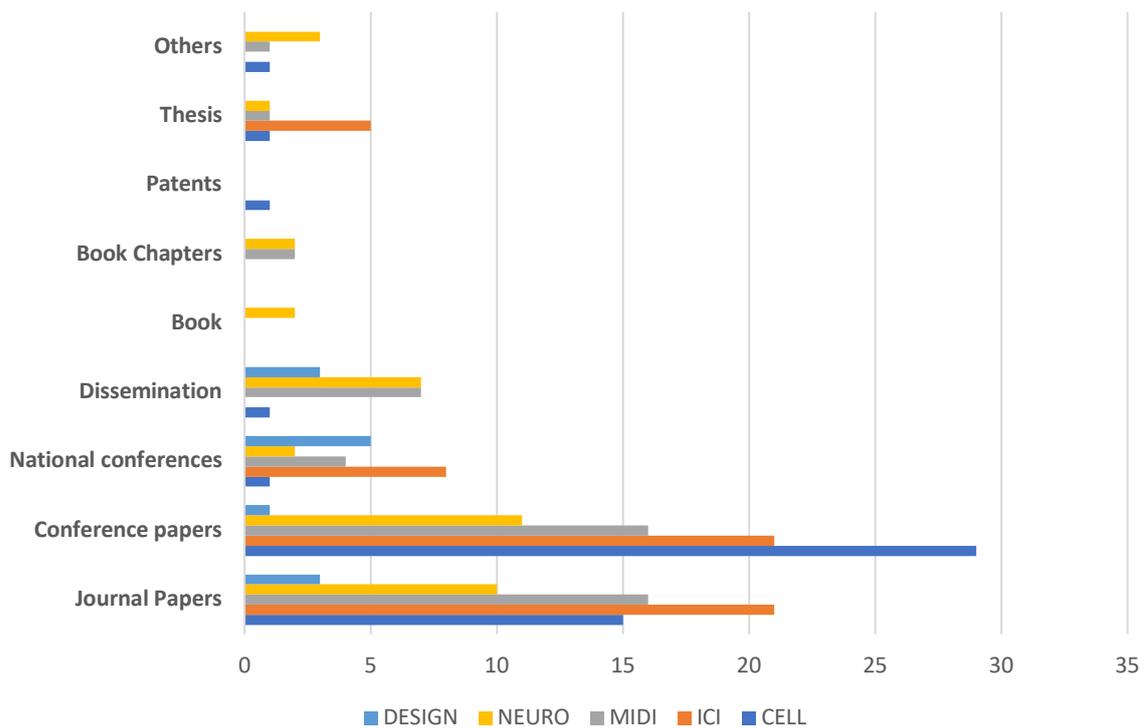
Publications - ETIS - 2019 to 2022

Legend: 2019, 2020, 2021, 2022

Categories: Journal Papers, Conference papers, National conferences, Dissemination, Book, Book Chapters, Patents, Thesis, Others
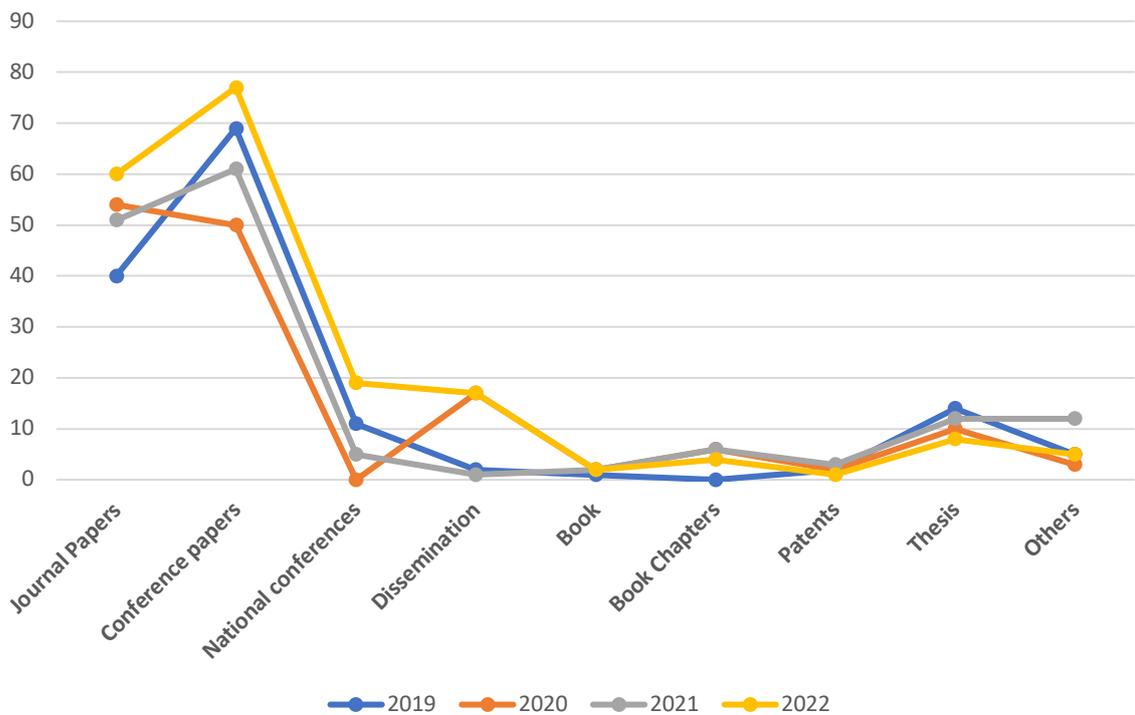
ETIS 2019-2022
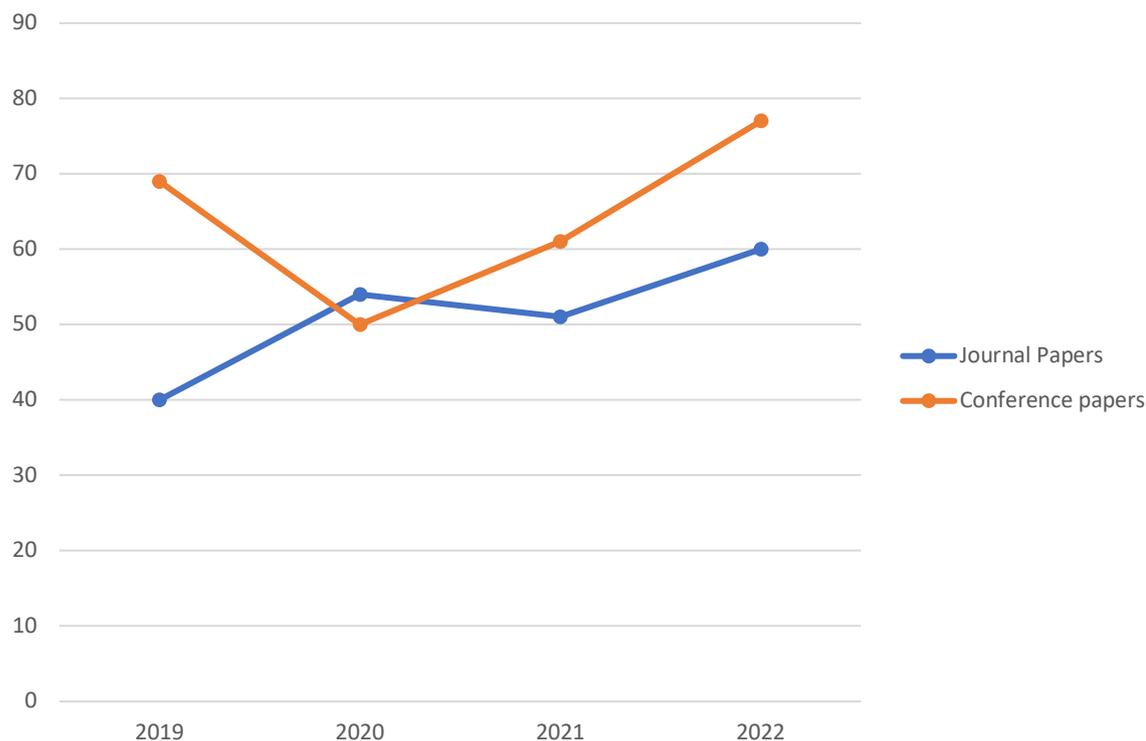
PhD and HDR

2022
PhD defended | | **HDR**
9 | 40.1 months | 2

From 2019
PhD defended | | **HDR**
45 | 44 months | 8

Teams	*PhD defended*	
CELL	3	*Besnier – 28/11/2022 – 36 months* *Colomer – 16/12/2022 – 37 months* *Thomet – 24/05/2022 – 39 months*
ICI	5	*Bello – 01/11/2022 – 36 months* *Bou Raphael – 01/12/2022 – 36 months* *Desportes – 16/12/2022 – 48 months* *El Hassani – 02/12/2022 – 36 months* *Saliba – 24/05/2022 – 54 months*
MIDI	2	*Ben Charrada – 06/05/2022 – 40 months* *Besnier – 28/11/2022 – 36 months*

NEURO	1	Colomer – 16/12/2022 – 37 months
Interteam	2	Colomer – 16/12/2022 – 37 months Besnier – 28/11/2022 – 36 months
ETIS	9 @ Doctoral School of CY	

PhD duration in months
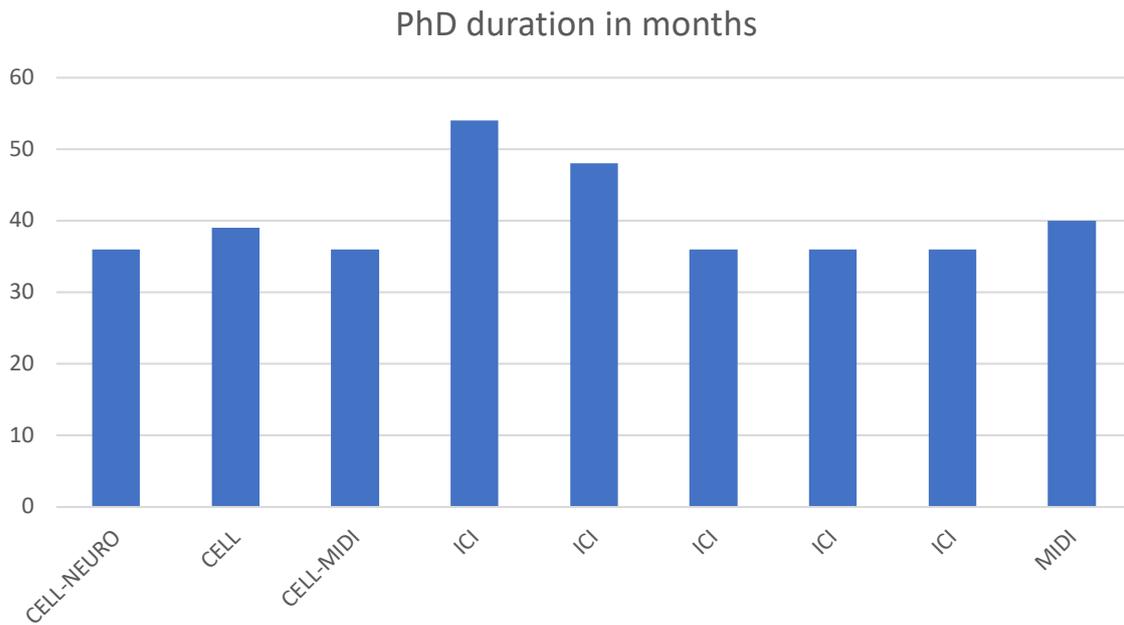
✚ Experimental equipments and platforms

> 79 scientific equipments	2 Equipex	- Robotex - Patrimex
	2 Equipex+	- Espadon - Tirrex
	8 platforms INS2I, CYU, ENSA	- Smart Gait - Smart Embedded Systems - Heritage - Image - Robotic and mobility - Processing

Budget and contracts

29 new contracts: 2.3M€ including	- 2 PEPR
	- 5 ANR
	- 1 FSP
	- 1 RISE
	- 7 CNRS (Unique, DERCI, IEA USA)
	- 3 PHC
	- 1 Horizon
	- 1 Erasmus+
75 ongoing contracts: 6.1M€ including	- 7 ANR
	- 10 INEX
	- 4 Labex
	- 3 EUTOPIA
	- 1 CNRS PRIME
	- 3 DIM
Budget / sponsors CYU -ENSEA-CNRS	- 169.3 k€ for functioning
	- 51k€ for equipment

Sponsors (CYU+CNRS+ENSEA)

Chart showing "Tutelles" values from 2012 to 2022:
- 2012: ~152000
- 2013: ~175000
- 2014: ~198000
- 2015: ~254000
- 2016: ~201000
- 2017: ~219000
- 2018: ~252000
- 2019: ~209000
- 2020: ~192000
- 2021: ~201000
- 2022: ~220000
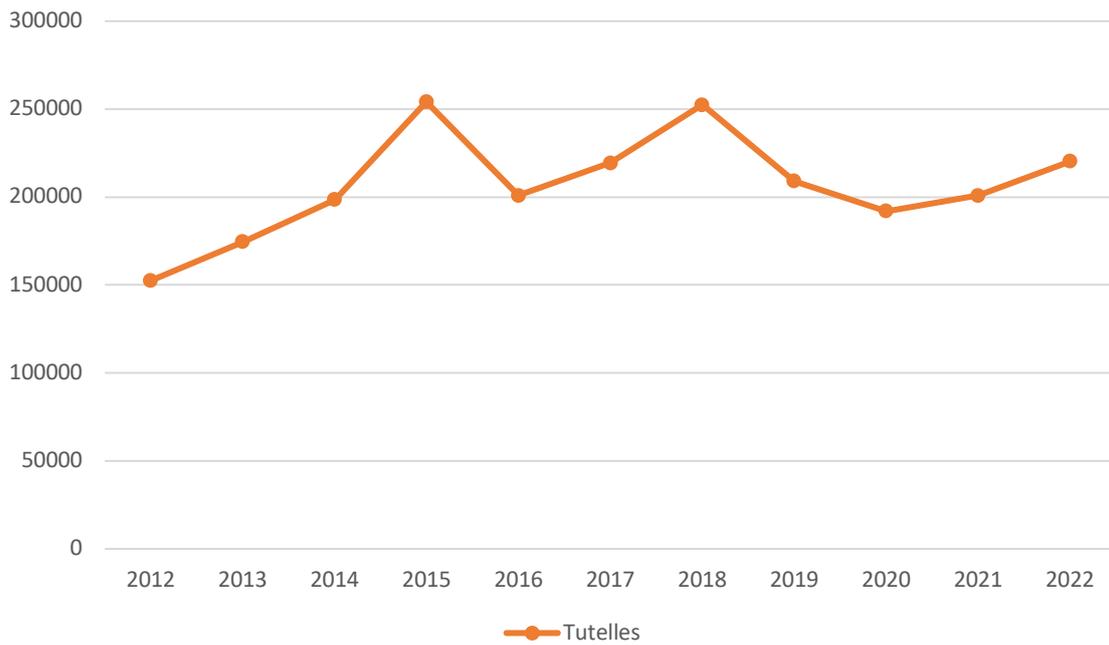
Arrivals and exits

Permanents	Arrivals	Exits
ETIS	• Allain Olivier, apprentice CNRS • Virginie Laizet, AI CNRS	• Cedric Dessennes, caesura
CELL	• Sylvain Iloga, PhD, MCF ESIEE-IT associated to the ETIS Lab	• Pierre Jacob, PhD. Now Assistant Professor at Labri, University of Bordeaux • Jordane Lorandel, MCF, joined the IETR Lab, University of Rennes, INSA.
ICI		• Ligong Wang, CR CNRS joined ETH
MIDI	• Guillaume Renton, Assistant Professor ENSEA	• David PICARD (now Professor LIGM)
NEURO	• Marwen Belkaïd, CPJ	
DESIGN	• Giulia Marcocchia, CPJ • Cynthia Snrec, Assistant Professor, CYU	

GDR and DIM

GDRs	CELL	ICI	MIDI	NEURO
IA		O	O	
ISIS	O	O	O	O
JEUX		O		
MACS				O
MADICS			O	
Mémoire				O
Robotique				O
RO		O		
Sécurité	O	O		
SoC2	O			
Sport	O		O	O

DIM	CELL	ICI	MIDI	NEURO
RFSI	O	O		O
MAP			O	
Math Innov		O		

ETIS in 2022

General presentation

General presentation

The laboratory was created in 1980 at the Ecole Nationale Supérieure de l'Electronique et de ses Applications (ENSEA) as the Image Processing Team, then ETIS with the addition of the Signal component. In 1991, ETIS became a joint team of ENSEA and the University of Cergy-Pontoise (UCP). Since 2002, ETIS is a joint research unit (UMR 8051) under the supervision of ENSEA, UCP and CNRS. At the CNRS, ETIS is mainly attached to the National Institute of Information Sciences and their Interactions (INS2I), and secondarily to the National Institute of Engineering Sciences (INSIS). Following the arrival in 2006 of three lecturer-researchers in databases (from the former Laboratoire d'Informatique de Cergy- Pontoise), then in 2009 of seven academics in analogue electronics (from the former EA ECIME), ETIS changed its name to Equipes Traitement de l'Information et Systèmes (Information Processing and Systems Teams), while retaining its ETIS acronym. The laboratory was successively directed by Jean-Pierre Cocquerez (1989-1999), Didier Demigny (2000-2004), Inbar Fijalkow (2005-2012) and Mathias Quoy (2013-2019). Since the 1st January 2020, the laboratory is directed by Olivier Romain (DU). In 2022, Lola Cañamaro became DUA of ETIS Lab and succeeds Véronica Belmega (DUA 2020 to 2022). The laboratory is located at the ENSEA (Cergy-Pontoise) and Cergy Paris University - CYU (Saint-Martin, Neuville sur Oise, Saint-Germain en Laye and Pau).
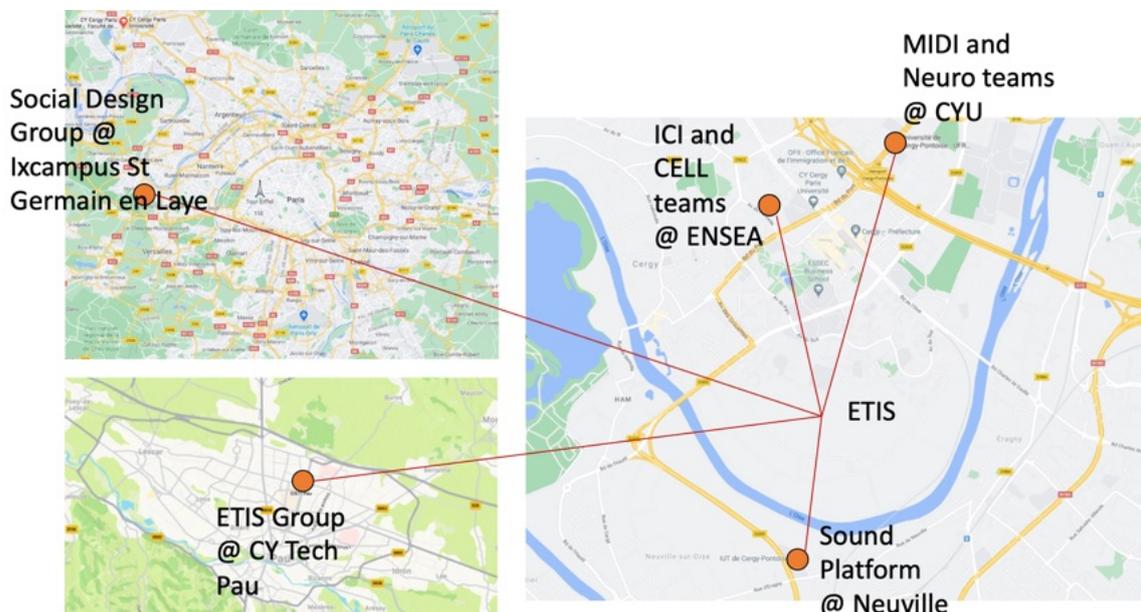
Scientific activities

ETIS has become a recognised laboratory and key player in the field of information processing. The research carried out is based on current societal challenges and concerns both the modelling of complex systems (cognitive models of behaviour, cooperative networks, reliable storage, etc.) and learning methods for self-adaptive intelligent systems (for data mining, interactive and autonomous robots, biomedical

implants, etc.). The societal challenges listed in the National Research Strategy - France Europe 2020 (SNR) are also the backdrop for our research activities, in particular, those concerning "the information and communication society", "life, health and well-being", "Freedom and security of Europe, its citizens and residents", and "mobility and sustainable urban systems". During the socio-economic and cultural interactions, at the laboratory level, each team adopts a "bottom-up" approach favouring the emergence of upstream issues in its theme while responding to questions emerging from concrete problems.

Teams and groups

In 2022, ETIS is composed of 4 teams: CELL, ICI, MIDI and NEURO and 1 research group in Design.
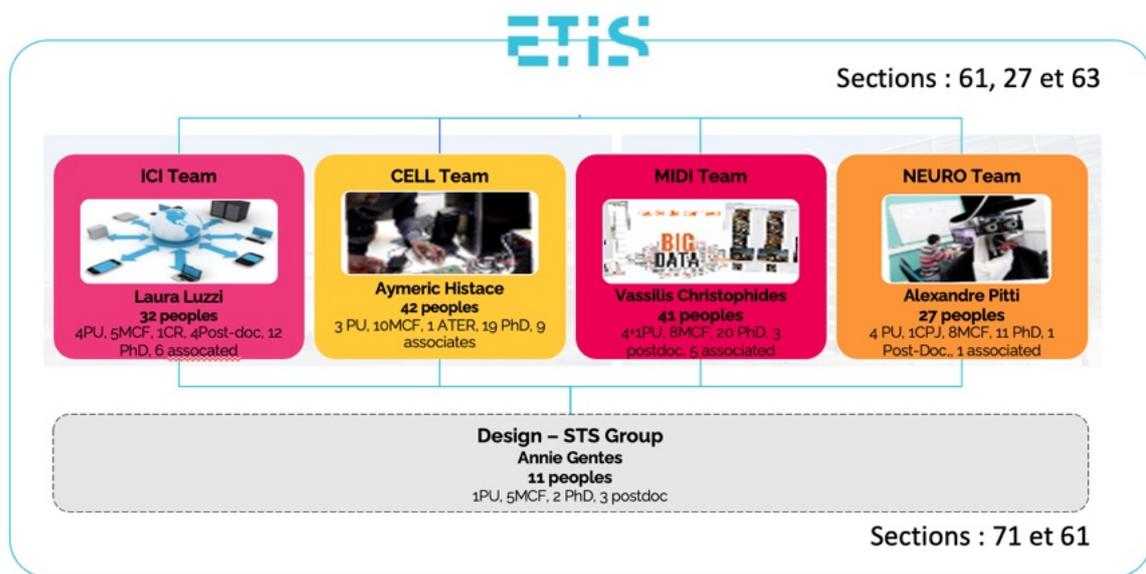
Highlights 2022

Projects
Awards
Publication
Appointment

Selected highlights

In 2022, the ETIS laboratory has demonstrated excellence and has again distinguished itself through awards, nominations, projects funded under PIA, PEPR, ANR, collaborative projects with industry, publications in high impact journals, etc.

A selection of these is presented below. All these highlights are completed in this report at team level and you can find more details on our website and other media.

- The ICI team was invited to take part in several coordinated projects of the **PEPR 5G** (PC3, PC4, PC5, PC6, PC7, PC8), under the CNRS banner, for a total budget of 1 240k€. The project will start in May 2023, and will involve the creation of the NextGenCom platform (ICI-CELL) at ETIS.

- Participation of the Design Research group in the **PEPR** AgroEcologie et Numérique leading by INRAE.

- V. Belmega obtained the **Top 5 papers recognition of the IEEE Trans. on Smart Grids**, paper co-authored with Dr. S. Laksminarayana and Prof. V. H. Poor (out of more than 1000 papers in the last 3 years)

- **First CPJ CYU-CNRS** – Chair de Professeur Junior, for Marwen Belkaïd on Neurobio modelling of brain structures: applications to learning and imitation for challenges in mobility, health and mediation.

- **Four new ANR projects** including the ANR ENHANCER leads by G. Mostafaoui, the ANR EXPIDA leads by K. Tzompanaki, the ANR JCJC leads K. Carrier and the ANR MRSEI leads by Florian Kölbl.

- Journal papers published in **PloS One, PNAS, NeuRIPS, VLDB – Very Large Data Base Journal, and Scientific Reports**,

- More than 20 invited talks in international conferences.

- **Mid-term evaluation of ETIS** by five external experts. The ETIS lab has been evaluated before the final evaluation by the HCERES in 2024. This exercise has been led by G. Sassatelli with the participation of G. Rekaya, C. Pelachaud, F. Marzani and J.M. Petit. The committee recognized the excellence of ETIS. Report is available on the website.

- **More than 20 events organized in 2022**

Valorisation and transfer 2022

Partnerships

Spin-offs

2 spin-offs

12 CIFREs

8 industrials projects (ANR PRCE, Subcontracting, …)

3 new Patents

Partnerships

ETIS is involved in numerous industrial and academic partnerships.

Either through PhD co-financing schemes (aka CIFRE doctoral fellowships) or through chairs (e.g., « IoT » Orange chair and « Data Analytics » Qwant chair).

Most partnerships are built upon long-standing links with major European industrial groups (IDEMIA, Védécom, SAGEM, CIRA, Partelec, 2CSI, M2M, QWANT, BOSCH, Thales, BIA, Nokia, Thales TCS, Huawei and LRMH, to quote but a few), cultural institutions (BnF French National Library, Musée du Louvre, Archives Nationales, Château de Versailles, C2RMF, RMN-GP) and governmental organizations (PJGN, CEA, IGN).

Other industrial collaborative projects comprise CRCC, Capital Vision, VEDECOM, IPANELA. In particular, CIFRE doctoral fellowships have been funded by Zodiac, Thales TRT, Thales Com, TRAPIL, Valéo, ASTRIUM, Axalot.

Spin-offs

SEQUENCIA: Sequencia is developing a solution to analyze, sequence and index in a multimodal way (text, image, sound (ou audio) and animation) any type of streaming or local videos to offer a multicriteria search engine monitored (or controlled) by a remote control (pause, fast forward/rewind, summary, zapping, playlist, DVD-like chaptering). The innovation lies in the total automation of the video content analysis processing chain, which aims to bring together the different points of view of each modality by integrating them into a distributed indexing process. IIn 2021, Boris Borzic, involved in Sequencia, obtained a rise program to support the development of Sequencia.

After the creation of Augmented-Endoscopy Spin off in 2019, the company obtained at the beginning of 2021 a French Tech Emergence grant from BPI jointly with a first raising of external funds (for a total of 150k€). In parallel, two patents were obtained in the U.S. in relation with the activity on videoendoscopy (classic and videocapsule). Aymeric Histace and Olivier Romain obtained for a 3-year period the "concours scientifique" status from their institutions (resp. ENSEA and CY) to support the valorization process of the work previously patented. Augmented Endoscopy obtained in 2022 the i-Lab award from BPI.
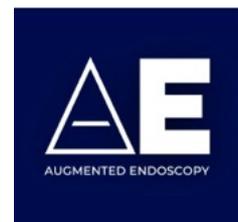
International 2022

Joint Lab with IPAL

EUTOPIA

International collaborations

Indicators 2022

2 theses ongoing with IPAL

60 ongoing international collaboration

9 ongoing EUTOPIA PhD contracts, 1 postdoc secondment

Overview

Project Manager Lola Cañamero

The international visibility of the unit is very good and has made important progress in particular since 2017, as highlighted by the HCERES evaluation in 2019. To continue and increase this visibility, ETIS has a proactive policy to increase its international scientific excellence in its research areas and strategic axes.

The international research collaborations are based on AAPs from the tutelles (CYU, ENSEA and CNRS), national (ANR PRCI), European and international programs. In 2022, the laboratory had more than 60active collaborations.

Main activities in 2022

EUTOPIA

The EUTOPIA European University alliance brings ten European universities aiming to become by 2025 an open, multicultural, confederated operation of connected campuses. In June 2019, the "EUTOPIA-2050" program was chosen as one of the initial 17 winning projects of the new European Universities Initiative competitive call launched by the European Commission to build a European Higher Education Area.

EUTOPIA grouped then 6 universities: Vrije Universiteit Brussel, CY Cergy Paris University, University of Gothenburg, University of Ljubljana, Pompeu Fabra University-Barcelona, The University of Warwick. The EUTOPIA Alliance was recently expanded to encompass a total of 10 regionally and nationally distinct European universities. New members are: Babeș-Bolyai University, Technische Universität Dresden, Ca' Foscari University of Venice, NOVA University Lisbon. Through the EUTOPIA alliance, the laboratory was able to initiate a significant number of PhD contracts in co-supervision with other universities of the Alliance (namely with VUB, Warwick and Pompeu Fabra), of which 1 started in 2022, with a total of 9 active in 2022. In addition, a postdoc in collaboration between the University of Gothenburg (host) and ETIS (secondment) was awarded in 2022.

IPAL

At the international level, actions to integrate the IPAL (CNRS IRL based in Singapore) partnership were initiated in March 2020. This collaboration is scientifically very meaningful since IPAL's thematic areas are close to those of ETIS (in particular artificial intelligence and machine learning with their applications in data science, IoT, human-machine interaction, etc.).

With the financial support of INEX, A*STAR and NUS, an agreement was signed in 2022 to fund the equivalent of 4 full doctoral contracts, in co-supervision with and co-funded by the French (CYU) and Singaporean (A*STAR and NUS) institutions. A first PhD was initiated in 2021 in collaboration between ETIS-CYU (Quoy) and A*Star (Chen) (student: Matthieu Goriot), a second one between ETIS-CYU (Cañamero) and NUS (Laschi) was approved in 2022, and the recruitment process started. Further PhD topics were submitted and the assessment started.

As highlights in 2022, we could mention:

1) The 6-month stay of Mathias Quoy (ETIS) at IPAL, supported by a CNRS grant (a "delegation"), starting in February 2022, and

2) The 2022 SinFra workshop held at IPAL in Singapore, on 15-16 June 2022, well attended by French and Singaporean IPAL researchers, with a scientific program of presentations around the key areas of Augmented Intelligence (A-I) & Human Computer Interaction (HCI); Natural Language and Dialogue Understanding; Efficient AI; Trusted, Secured and Explainable AI, and Data Science & Applications.

Both activities were very successful in terms of both research exchanges and the opportunities they offer to discuss and start new international collaborations with IPAL.

Equality and Parity

Missions
Activities in 2022

Equality Parity missions

*Project Manager
Lilyana Petrova*

For an INS2I laboratory with a strong emphasis on fundamental and experimental sciences, the laboratory can pride itself on having a strong female component. The reinforcement of the laboratory's human resources is very good and is constantly evolving with a rate of about 33% of women in the unit.

ETIS also has an internationally recognized team of Télécom Girls in the ICI team. This parity policy is the result of constant work initiated several years ago to raise awareness, promote and support female colleagues in science. Our actions are perfectly in line with the CNRS and INS2I policy on gender equality, and must be supported because there is still considerable room for improvement.

During the 2022 year, Lilyana Petrova (MCF ENSEA) succeeds Katerina Tzompanaki as project manager in charge of equality and parity missions. She enlarges the peremiter of the perimeter to the question of alterity.

The ETIS laboratory has been pursuing a policy of gender equality for several years, in close collaboration with our supervisory bodies and the INS2I Institute, that including:

o Raise awareness about parity problems in science-related professions, about biases, stereotypes, etc.

o Promote a spirit of collaboration, respect and tolerance among its members.

o Develop measures to encourage female students to continue in STEM related domains.

o Accompany and support female researchers after a maternity leave.

o Reward and promote the work of female researchers.

Main activities in 2022

o The Equality-Parity Charter of the ETIS members, written in French (https://www.etis-lab.fr/wp-content/uploads/2022/06/Charte_egalite_ETIS_2 022.pdf), English (https://www.etis-lab.fr/wp-content/uploads/2022/07/Charte_egalite_ETIS_2 022_EN.pdf) and Chinese (https://www.etis-lab.fr/wp-content/uploads/2022/07/Charte_egalite_ETIS_2 022_ZH.pdf) .

o The book "Femme Scientifiques d'ETIS" (Women in Science at ETIS), and video, https://www.etis-lab.fr/2022/12/16/ten-inspiring-women-scientists/

o Participation in events that aim to attract and inspire young girls in digital sciences (e.g., Femmes en Sciences organized by AFNEUS, Fête de la Science).

o Supporting the Prix 2022 des Femmes et des Sciences pour CY Alliance https://www.cyu.fr/cy-alliance-remise-du-prix-2022-%C2%AB-des-femmes-et- des-sciences-%C2%BB

Communication

Missions
Activities in 2022

Communication missions

ETIS is involved in any actions related to communication, dissemination, and science popularisation, ETIS researchers are encouraged to communicate about their research results and publications, and more particularly in coordination with the CNRS, CY Cergy Paris University and ENSEA.

The ETIS laboratory participates each year in the national science festival that takes place in October and aims to present research subjects and results to wide audience.

Project Manager
Maria Malek

ETIS maintains also close relationship with the INS2I communication and valorisation services, for example, individual interviews with several researchers were organised with the CNRS communication service with the aim of disseminating their research topics and results.

Moreover, emphasis was placed this year on setting up the achievement of the communication supports of the laboratory (flyer, web site, Kakemono, logo, templates, etc.), where work teams were formed to define theses communication supports, the graphic charter was defined in collaboration the Neway Partners society.

Main activities of communication in 2022

In the context of the annual national science festival, many ETIS members have participated to events proposed and organised by the research direction of CY Alliance as well as the CNRS delegation DR05:

October 1: members of the Neurocybernetic team participated to an animation on a stand at the 3 Fontaines shopping center, by the presence of the robot Ferdinand. Likewise, ETIS doctoral students present a measuring mat and their event camera where new technologies to assess a person's sports performance while respecting privacy with low energy consumption were presented.

October 12: On the occasion of the screening of the movie ***Five news from the brain*** at the Utopia Cinema at Saint-Ouen-l'Aumone, three researchers form ETIS: Lola Canamero, Philippe Gaussier and Alexandre Pitti have animated a very interesting debate in relation to this movie.

October 13: Participation at the "Visites Insolites du CNRS" *https://visiteinsolites.cnrs.fr*: we welcome small groups of people who visited the three sites of ETIS (Saint-Matin, Neuville sur Oise, ENSEA) where researchers presented their topics using posters, demonstrations, fun games, and virtual immersion. Presented themes were:

o Humanoid robots on the school bench,

o A laboratory apartment to study noise pollution,

o 3D Modelling and virtual reality,

o Smart embedded systems for Health Care platform,

Student Club

Overview
Activities in 2022

Overview

The PhD Student Club (aka graduate student association) aims to promote the integration of PhD students in ETIS and to participate in its scientific life by organizing events and seminars. Stephane Zuckerman, Project Manager, supports the development of the activities.

For this year, the Club is managed by a two PhD students from ETIS at ENSEA (Laure Acin and Alexandre Bordat), following on from Clara Bremond and Théo Serru.

Project Manager Stéphane Zuckerman

The Club organizes outings or casual online meetings on a regular basis to create interactions between PhD students coming from a range of research groups.

Il also holds a Journal Club twice a month, open to the whole lab and whose topic span various research themes at ETIS.

Finally, the club organizes an annual PhD students all-day conference, an opportunity for every PhD student to present his/her work to a large audience in the form of short talks followed by a poster session.

Main activities in 2022

In 2021, the Club supported the following activities:

- o Organization of the "Annual Day of PhD"
- o Monthly seminar

21/01/22	Alexandre BORDAT	*Introduction à la problématique de chute chez les personnes âgés ainsi qu'une technologie innovante de prévention et détection de chute utilisant l'imagerie non-conventionnelle (RADAR)*
11/02/22	Pierre JACOB	*A Universal Law of Robustness via Isoperimetry*
11/03/22	JDD	*Annual evaluation*
31/03/22	Louis Annabi	*Differentiable Causal Discovery from Interventional Data*
10/06/22	Petr DOBIAS	*How to map and schedule applications on different systems?*
08/07/22	*Special Session on the CVPR:* *- Laure ACIN* *- Clara BREMOND* *- Pierre JACOB* *- Tharsan SENTHIVEL*	*- Multi-grained Spatio-Temporal Features Perceived Network for Event-based Lip-Reading* *- CO-SNE: Dimensionality Reduction and Visualization for Hyperbolic Data* *- One Loss for Quantization Deep Hashing with Discrete Wasserstein Distributional* *&* *HODEC: Towards Efficient High Order Decomposed Convolutional Neural*

	- Alexandre BORDAT - Loïc JEZEQUEL	Networks - Accelerating DETR Convergence via Semantic-Aligned Matching - Exploiting Temporal Relations on Radar Perception for Autonomous Driving - Pooling Revisited: Your Receptive Field is Suboptimal
30/09/22	Short Session: - Théo SERRU - Pauline ROUSSEAU - Jean Christophe RICKLIN	- Swimming IoT Or How To Hack A Vessel - Classification of Complaints for Criminal Intelligence Purposes. - Thesis subject presentation
19/10/22	Stéphane ZUCKERMAN	Réunion sur la qualification MCF / post-thèse
18/11/22	Nicolas LARUE	Data Preprocessing for deep learning
18/11/22	Tharsan SENTHIVEL	Transformers

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CELL

SMART
EMBEDDED
SYSTEMS

General presentation

The CELL team is a multidisciplinary team in the field of intelligent embedded systems. It brings together academics from the fields of electronics (microelectronics, analog, digital and wave electronics), signal and image processing (computer vision in general) and computer science. The work carried out in the team concerns fundamental subjects related to embedded systems (reliability, energy, reconfigurability, processing under computing resource constraints, non-conventional sensors, communication protocol) embodied through application projects in the fields of health, safety, and communicating systems (IoT, autonomous vehicle).

This particularity leads the team to develop several projects in collaboration with the other teams of the laboratory (embedded ML with the MIDI team, Adéquation Algorithme Architecture for error correcting codes with the ICI team, event-based camera with the Neurocybernetics team) and in connection with experts in the targeted application domains. Thus, the team welcomes several associated researchers or external partners including a PU-PH from the APHP at 100% of its research time, an EC from the University of Glasgow in the field of UWB, and members of the Pôle judiciaire de la gendarmerie nationale (PJGN) located in Pontoise. Since 2019, the team also welcomes associate researchers from CY-Tech (CY Paris Cergy University) and ESIEE-IT.

Highlights in 2022

In July 2022, CELL team organized a dedicated workshop to begin the work on the project to be presented to HCERES. This event was organized with the help of Lilyana Petrova from the Design and STS Group of ETIS. It was a great moment of interdisciplinarity.

Arrivals

This year 4 new PhD students have been welcomed in the team. Sylvain lloga has also joined the team. He is associated with the lab for the next 3 years through a position at ESIEE-IT school of engineering.

Departures

In September 2022, Jordane Lorandel left ETIS to join the IETR Lab.

Technological platforms

In 2022, the plateform "Atelier du movement" was consolidated in terms of equipment through co-funding from DIM RFSI, IDF, ENSEA, CYU and CNRS.

Focus "publications and awards"

In 2021 the team maintained a good level of publication in international journals with 13 items (same as last year). This is an important point since part of the research activity needs a full working demonstrator to be published. We have managed to find a balance between the different aspects of the research activities related to data processing and circuits / embedded systems but also on the considered application areas (health, telecommunication, autonomous vehicle).

Representative papers and awards on topics of the team, are:

- Clara Brémond was awarded the 6th prize for Women and Science of CYU as a doctoral student ("Prix CY Alliance Des Femmes et des Sciences 2022, catégorie doctorante")

- The work on automatic classification of bloodsucking insects using Deep Neural Network has been published in Scientific Reports (Nature)

- The work on Embedded AI for EEG classification has been published in Frontiers in Human Neurosciences

Transfer and Valorization

It is also worth mentioning that the team has also maintained its transfer and valorization activities: after the creation of Augmented-Endoscopy Spin off in 2019, the company was awarded the i-Lab 2022 (BPI prize). At the end of 2022, this dynamic makes it possible to rise new investors.
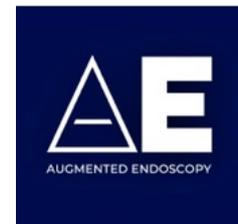
KPI of CELL in 2022

Since March 2019, the team has been organized into three research areas: (i) the "Reconfigurable Trusted Architectures" (RTA) axis, the "Agile Circuit for Telecommunications" (ACT) axis and the "Smart Embedded Systems" (SES) axis. Each of them enables the creation of a core of expertise around a common theme and the organization of interaction at the scientific strategy level of each of them within the team and with the other ETIS teams.

Members

- At the 31 December 2022, the team was composed of the following members:
    - 22.5 permanents
        - 3 Full Professors (1 UCP, 2 ENSEA)
        - 10 Assistant Professor including 3 HDR
        - 6 Associate researchers from ESIEE-IT (3) and CY-Tech (3)
        - 1 PU-PH of the APHP-Saint Antoine Hospital
        - 1 Associate researcher from Pôle Léonard de Vinci
        - 1, ½ CNRS Engineers
    - 20 non-permanents:
        - 20 PhD students (all types of funding)

In – Out

- In :
  - Sylvain Iloga, PhD, Assistant Professor, ESIEE-IT associated to the ETIS Lab

- Out:
  - Pierre Jacob, PhD. Now Assistant Professor at Labri, University of Bordeaux
  - Jordane Lorandel, MCF, joined the IETR Lab, University of Rennes, INSA.

New PhD

Name	Supervisor	Partner	Type	Start	Title
MONTMAUR	HISTACE	AID-DGA	ED	14/11/2022	Self-supervised continual learning for dynamic data and AI safety
BERANGER	ROMAIN	IDF - BlueLinea	IDF 90% Entreprise 10%	01/06/2022	Gait recognition and fall prediction with deep learning on micro-doppler signatures
DA COSTA	ARIAUDO	STMicroelectronics SA	CIFRE	16/11/2022	Fully integrated broadband RF FE architecture for IOT applications
BOUHLEL	HISTACE	LRMH FSD	Contrat doctoral	01/10/2022	Contribution to the mechanical diagnosis of a wooden structure of heritage

Ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
BREMOND	SIMON-CHANE HISTACE CLOUCHOUX	NEOXIA	CIFRE	01/04/2020	Extraction and characterization of 3D shapes for regional quantification of massive data.
DILLEN	GHAFFARI ROMAIN	VUB	EUTOPIA	21/09/2020	Brain-Computer Interface for real-life applications
ELOUARET	ZUCKERMAN KESSAL ROMAIN	VEDECOM	INEX	03/12/2018	Online scheduling of software and hardware tasks for FPGA-based architectures
LEENHARDT	DRAY HISTACE	-	APHP	02/12/2019	Development of automated computer assisted diagnosis tool for small bowel capsule endosocpy.
REGNACQ	KOLBL ROMAIN	ANR	ANR BIOTIF	21/11/2019	Modeling an Design of a focal stimulator for the peripheral nervous system based on non-conventional waveforms.
SERRU	NGUYEN	APSYS	INEX	01/10/2020	Security and Safety of Complex Systems with AltaRica
TALBI	NGUYEN	PJGN	PJGN	1/11/2020	Static Bytecode Analysis and Machine Learning for Backdoor Detection
THOMET	GHAFFARI ROMAIN	ST Micro	CIFRE	06/02/2019	Enhanced Observation Framework for embedded systems exposed to radiations
ACIN Laure	SIMON-CHANE HISTACE	ENSEA	ED	23/11/2021	HYPER-EYE: Machine Learning Algorithms for Event-Based Camera
BORDAT Alexandre	ROMAIN DOBIAS	BLUELINEA	CIFRE	01/09/2021	Early estimation of signs of biomechanical failure by non-conventional radar imaging.Applications to robust fall prediction in the elderly.
COUPPEY Thomas	KOLBL FRANCAIS ROMAIN	ESIEE	ED	01/09/2021	Coupling of electrical and electrochemical spectroscopy analyzes for monitoring in-vitro and in-vivo biological environments
TALEB Ihab	NGUYEN	ESILV	H2020-	01/10/2021	Multi-agent modeling for smart grid in island area

Interteam ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
ABDELWAHED	PITTI ROMAIN	VEDECOM	CIFRE	18/10/2018	*Adaptive Impedance Spectroscopy for Characteristic Extraction and Exploitation of Artificial Skin: Application to Mobile Robotics as autonomous vehicule*
BESNIER	PICARD HISTACE	VALEO	CIFRE	21/11/2019	*Safety of automotive systems using Machine Learning*
COLOMER	CUPERLIER BRESSON ROMAIN	VEDECOM	CIFRE	05/11/2019	*Integrated neuro-robotic approaches for autonomous vehicle localisation and navigation.*
JEZEQUEL	VU HISTACE	IDEMIA	CIFRE	01/09/2020	*Spoof detection by semi-supervised deep learning*
SASSI	NGUYEN CHELOUAH	PJGN	PJGN	19/09/2019	*Artificial intelligence for intrusion detection via connected objects*

HDR Defended

Name	Guarantor	Date of defended	Title
Le KERNEC, Julien	ROMAIN	07/12/2022	*How to optimise detection/recognition with radar sensing and fusion?*

PhD Defended

Name	Supervisor	Partner	Type	Start	Date of defended	Length	Title
COLOMER	CUPERLIER BRESSON ROMAIN	VEDECOM	CIFRE	05/11/2019	16/12/2022	37 months	*Integrated neuro-robotic approaches for autonomous vehicle localisation and navigation.*
THOMET	GHAFFARI ROMAIN	ST Micro	CIFRE	06/02/2019	24/05/2022	39 months	*Enhanced Observation Framework for embedded systems exposed to radiations*
BESNIER	PICARD HISTACE	VALEO	CIFRE	21/11/2019	28/11/2022	36 months	*Safety of automotive systems using Machine Learning*

Publications (cf. HAL)

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	HDR
15	29	1				1	3	1

Publications with others teams of ETIS (cf. HAL)

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
2	7	1						

New contracts – funding

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)

AID-DGA	ENSEA	CONTRAT DOCTORAL	HISTACE	01/11/2022	36 months	60 000€	60 000€
AAP DEEPTERA	CNRS	INS2I	SIMON CHANE	01/02/2022	11 months	10000€	10000€
AAP DSCA Afrique Sub saharienne	CNRS	DERCI	ROMAIN	01/10/2022	?????	10000€	10000€
NEUMOD	CY	ANR	KOLBL	15/07/2022	2 years	26 272€	26 272€
RISE INOVEC	Horizon Europe	Staff exchange	Camille Sinon-Chane / Aymeric Histace	01/01/2023	5 years	2M€	40000€

Ongoing contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
CIFRE BLULINEA	CNRS	CIFRE	ROMAIN	11/02/2022	3 years	15 000€	15 000€
NEUMOD	CY	ANR	KOLBL	15/07/2022	2 years	26 272€	26 272€
DIM RFSI	CY	PhD	ROMAIN	22/07/2021	6 years	100 000€	100 000 €
HAAP INEX 2021 IPAL/A-STAR	CYU	ANR IDEX + IPAL	ROMAIN	01/01/2021	5 years	1 280 538€	345 000€
HYPER EYE	ENSEA	CONTRAT DOCTORAL	HISTACE / SIMON-CHANE	08/11/2021	36 months	94 621€	94 621€
ATELIER DU MOUVEMENT	ENSEA	DIM RFSI	ROMAIN	28/05/2021	17 months	27 720€	27 720€
Etude des fragilités par imagerie non-conventionelle	ENSEA	DIM RFSI	ROMAIN	2/12/2021	29 months	19 400€	19 400€
DOC ASYST Technopole de la réunion	ENSEA	Contrat de prestation industrielle	HISTACE	15/11/2021	4 months	12 000€	12 000€
BIOTRACK	ANR	PRCI	ROMAIN	2021	3 years	-	-
EXPERTIME	CY	CIFRE	ROMAIN	15/03/2020	3 years	45 000€	45 000€
NEOXIA	ENSEA	CIFRE	HISTACE/SIMON-CHANE	01/04/2020	3 years	45 000€	45 000€
SEEING	CY	INEX	KOLBL	01/02/2019	3 years	117 500€	117 500€
VALEO	ENSEA	CIFRE	HISTACE	04/11/2019	3 years	379 800€	45 000€
QCSP	ENSEA	ANR	GHAFFARI	01/10/2019	4 years	787 608€	80 000€
HAPIVULN	DIM RFSI	Scientific equipment	LORANDEL	15/09/2020	25 months	6822€	6822€
EXPERTIME	ANRT	Thesis CIFRE	ROMAIN	15/03/2020	3 years	45 000€	45 000€
DEEPTERA	CYU / University of Mauritius	Travel	HISTACE SIMON-CHANE	01/09/2020	12 months	20 000€	20 000€
BioTIF	ABR CRCNS	Thesis	ROMAIN KOLB	20/03/2019	36 months	178 300€	178 300€
SSA	PIA	Thesis	NGUYEN	1/10/2019	36 months	274 210€	60 000€

Scientific Dissemination

Event Organization

Name	Type	Role	Involved	Date	Country
25th Euromicro DSD/SEAA2022 special session on advanced systems for health, wellness and personal assistance (ASHWPA)	Special Session	Program committee	ROMAIN	31 August to 2 September 2022	Gran Canaria, Spain

Scientific Expertises in national and international committees in 2021

Name	Role	Involved	NB
GDR SoC2	GT Chair	ROMAIN	
GDR SoC2	GT animation	LORANDEL	
ANR	Vice-Presidence of CES45	HISTACE	"Mathématiques et Sciences du Numérique pour la Biologie et la Santé"
Prix science ouverte des données de la recherche	Jury member	SIMON CHANE	

PhD and HDR juries

Name	Type	Role	Involved	Date	Where
BOTINA MONSALVE Johan	PhD	Reviewer	HISTACE	10/2022	University of Burgundy, ImVia
AL ALII Safaa	PhD	Reviewer	HISTACE	07/2022	University Paris 13
ZHANG Jing	PhD	Reviewer	HISTACE	03/2022	University of Rouen, LITIS
DEZAN Catherine	HDR	Reviewer	ROMAIN	09/2022	UBO, LabSticc
GOUIN Alexandre	PhD	Reviewer	ROMAIN	05/2022	Univeristy of Rennes 1, IETR
Le KERNEC Julien	HDR	Scientific Guarantor	ROMAIN	12/2022	CYU

Scientific Mediation (national)

HISTACE / DRAY	Webinaire de la SFED "L'Odyssée de l'Endoscopie"	24/06/21	L'IA pour les nuls et IA pour l'analyse en vidéocapsule de l'intestin grêle	200 inscrits, gastroentérologues, industriels du domaine, étudiants	Médiation + Séminaire
HISTACE / DRAY	Cycle de séminaires "IA" de la cité scolaire Paul Valéry (Campus IA)	10/06/21	Santé et IA : un exemple d'application de l'IA pour l'aide au diagnostic en gastroentérologie	Elèves du lycée Paul Valéry, membres des équipes pédagogiques du lycée.	Médiation

New Platform

2022 has been focused on the development and set up of the Plateforme du Mouvement (see above).

Research perspectives for 2022

2022 will be a particular year for the team (and for the lab) as we will prepare a summer mid-term evaluation of our activities. It will be for the team the opportunity to think about how the members see CELL in 2-3 years to propose several axes of evolution in

the way we think we could be structured around scientific questions in close relation with societal issues. The arrival of new colleagues is directly in line with this strategy to help them to integrate the team optimally. Several workshops will happen between March and June to have solid ideas to discuss and implement before the end of 2022. These discussions will also be motivated by the possibility to build a joint project for the team that will be submitted to the next ANR call in the PRME category for instance.

At a short-term perspective, CELL will remain in line with its 3 current research axis in terms of concrete activities and will pursue the objectives of working on projects at the frontier of fundamental research in smart embedded systems and well defined application domain in which the team has developed through the last 10 years expertise and visibility (Health, IoT, Security, etc.). Joint project with other teams of ETIS will also remain an important objective and in parallel, the different technological platforms will be strengthened in terms of equipment and activities with the arrivals of our new colleagues.

Publications 2022

Journals

1. *Theo Serru, Nga Nguyen, Michel Batteux, and Antoine Rauzy. Modeling Cyberattack Propagation and Impacts on Cyber-Physical System Safety: An Experiment. Electronics, 12(1):77, December 2022a. doi: 10.3390/electronics12010077. URL https://hal.science/hal-03919905.*

2. *Louis Regnacq, Yannick Bornat, Olivier Romain, and Florian Kolbl. BIMMS: A versatile and portable system for biological tissue and electrode-tissue interface electrical characterization. Hard- wareX, 13:e00387, December 2022. doi: 10.1016/j.ohx.2022.e00387. URL https://hal.science/ hal-03920058.*

3. *Arnaud Cannet, Camille Simon-Chane, Mohammad Akhoundi, Aymeric Histace, Olivier Romain, Marc Souchaud, Pierre Jacob, Pascal Delaunay, Darian Sereno, Philippe Bousses, Pascal Gre- baut, Anne Geiger, Chantel de Beer, Dramane Kaba, and Denis Sereno. Wing Interferential Pat- terns (WIPs) and machine learning, a step toward automatized tsetse (Glossina spp.) identifica- tion. Scientific Reports, 12(1):20086, December 2022. doi: 10.1038/s41598-022-24522-w. URL https://hal.science/hal-03874077.*

4. *Mehdi Abdelwahed, Lounis Zerioul, Alexandre Pitti, and Olivier Romain. Using Novel Multi- Frequency Analysis Methods to Retrieve Material and Temperature Information in Tactile Sensing Areas. Sensors, 22(22):8876, November 2022. doi: 10.3390/s22228876. URL https://hal.science/ hal-04003685.*

5. *Ola Selnes, Thomas Bjørsum-Meyer, Aymeric Histace, Anastasios Koulaouzidis, and Gunnar Baatrup. Annotation Tools in Gastrointestinal Polyp Annotation. Diagnostics, 12(10):2324, September 2022. URL https://hal.science/hal-03790004.*

6. *Sylvain Iloga. Histogram-based comparison of metric spaces using HMMs. Evolutionary Intelli- gence, September 2022a. doi: 10.1007/s12065-022-00773-4. URL https://inria.hal.science/ hal-03769827.*

7. *Sylvain Iloga. Accurate comparison of tree sets using HMM-based descriptor vectors. Revue Africaine de Recherche en Informatique et Math ématiques Appliqu ées, Volume 36 - Special issue CRI 2021, August 2022b. doi: 10.46298/arima.9107. URL https://hal.science/hal- 03582092.*

8. *Arnau Dillen, Elke Lathouwers, Aleksandar Miladinovi ċ, Uros Marusic, Fakhreddine Ghaffari, Olivier Romain, Romain Meeusen, and Kevin de Pauw. A data-driven machine learning approach for brain- computer interfaces targeting lower limb neuroprosthetics. Frontiers in Human Neuroscience, 16, July 2022a. doi: 10.3389/fnhum.2022.949224. URL https://inria.hal.science/hal-03741746.*

9. *Charles Houdeville, Romain Leenhardt, Marc Souchaud, Guillaume Velut, Nicolas Carbonell, Isabelle Nion-Larmurier, Alexandre Nuzzo, Aymeric Histace, Philippe Marteau, and Xavier Dray.*

Evaluation by a Machine Learning System of Two Preparations for Small Bowel Capsule Endoscopy: The BUBS (Burst Unpleasant Bubbles with Simethicone) Study. Journal of Clinical Medicine, 11(10):2822, May 2022a. doi: 10.3390/jcm11102822. URL https://hal.science/hal-03670144.

10. *Rub én Laso, Oscar G. Lorenzo, Jos é C. Cabaleiro, Tom ás F. Pena, Juan-Angel Lorenzo-Del-Castillo, and Francisco F. Rivera. CIMAR, NIMAR, and LMMA: Novel algorithms for thread and memory migrations in user space on NUMA systems using hardware counters. Future Generation Computer Systems, 129:18–32, April 2022. URL https://hal.science/hal-03436018.*

11. *Arnau Dillen, Denis Steckelmacher, Kyriakos Efthymiadis, Kevin Langlois, Albert de Beir, Uros Maru- sic, Bram Vanderborght, Ann Now è, Romain Meeusen, Fakhreddine Ghaffari, Olivier Romain, and Kevin de Pauw. Deep learning for biosignal control: insights from basic to real-time methods with recommendations. Journal of Neural Engineering, 19(1):011003, February 2022b. doi: 10.1088/1741- 2552/ac4f9a. URL https://inria.hal.science/hal-03639189.*

12. *Valerie Lee, Julien Longhi, David Picard, Camille Simon Chane, and Michel Jordan. Les outils de l'apprentissage profond au service de l' évaluation et de la conservation des archives. Conservation- restauration des biens culturels, (38):7–16, 2022a. URL https://hal.science/hal-03620940.*

13. *Tongsheng Geng, Marcos Amaris, St éphane Zuckerman, Alfredo Goldman, Guang Gao, and Jean-Luc Gaudiot. A Profile-Based AI-Assisted Dynamic Scheduling Approach for Heterogeneous Architec- tures. International Journal of Parallel Programming, 50(1):115–151, 2022. doi: 10.1007/s10766- 021-00721-2. URL https://hal.science/hal-03606185.*

14. *Romain Leenhardt, Anastasios Koulaouzidis, Aymeric Histace, Gunnar Baatrup, Sabina Beg, Ar- naud Bourreille, Thomas de Lange, Rami Eliakim, Dimitris Iakovidis, Michael Dam Jensen, Martin Keuchel, Reuma Margalit Yehuda, Deirdre Mcnamara, Miguel Mascarenhas, Cristiano Spada, Santi Segui, Pia Smedsrud, Ervin Toth, Gian Eugenio Tontini, Eyal Klang, Xavier Dray, and Uri Kopylov. Key research questions for implementation of artificial intelligence in capsule endoscopy. Therapeutic Advances in Gastroenterology, 15:175628482211326, January 2022. doi: 10.1177/17562848221132683. URL https://hal.science/hal-03836599.*

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Books and Chapters

1. *Jorge Bernal, Aymeric Histace. Computer-Aided Analysis of Gastrointestinal Videos, Springer International Publishing, 187 p., 2021, 978-3-030-64339-3.*

2. *ML Becoña, OG Lorenzo, TF Pena, JC Cabaleiro, FF Rivera, JA Lorenzo, A Tool for Runtime Analysis of Performance and Energy Usage in NUMA Systems, Tools for High Performance Computing 2018/2019, 85-99, 2021.*

Dissemination papers

1. *Xavier Dray, Aymeric Histace, Romain Leenhardt. L'IA appliquée à la vidéocapsule endoscopique de l'intestin grêle : état de l'art et perspectives, E. Coron, G. Vanbiervliet. Intelligence artificielle et maladie digestive, Le Grand Métier, pp.33-45, 2021*

Patents

1. *"using spectral EIT in artificial skin for detection and thermal detection", M. Abdelwahed,   O. Romain, L. Zerioul, A. Pitti, sept 2022.*

Conference papers

1. *Jordan Rey-Jouanchicot, Juan-Angel Lorenzo-Del-Castillo, St éphane Zuckerman, and E Veron ica Belmega. Energy-efficient online resource provisioning for cloud-edge platforms via*

multi-armed bandits. In Workshop on Cloud Computing - 34th International Symposium on Computer Archi- tecture and High Performance Computing (SBAC-PAD), Bordeaux, France, November 2022. URL https://hal.science/hal-03813967.

2. Pierre Jacob, David Picard, and Aymeric Histace. Improving Deep Metric Learning With Virtual Classes And ExamplesMining. In International Conference on Image Processing (IEEE ICIP), Proceedings of IEEE ICIP 2022 Conference, Bordeaux, France, October 2022. IEEE. URL https://hal.science/hal-03740481.

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5. Shaoshan Liu, Xiaoming Li, Tongsheng Geng, Stephane Zuckerman, and Jean-Luc Gaudiot. Program- ming Autonomous Machines : Special Session Paper. In 2022 International Conference on Embedded Software (EMSOFT), pages 24–33, Shanghai, United States, October 2022. IEEE and ACM, IEEE. doi: 10.1109/EMSOFT55006.2022.00018. URL https://hal.science/hal-04140486.

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9. Alexandre Bordat, Petr Dobias, Julien Le Kernec, David Guyard, and Olivier Romain. GPU Based Implementation for the Pre-Processing of Radar-Based Human Activity Recognition. In 2022 25th Euromicro Conference on Digital System Design (DSD), pages 593–598, Maspalomas, Spain, August 2022a. IEEE. doi: 10.1109/DSD57027.2022.00085. URL https://hal.science/hal-03930347.

10. Loic Jezequel, Ngoc-Son Vu, Jean Beaudet, and Aymeric Histace. Semi-Supervised Anomaly Detection withContrastive Regularization. In International Conference on Pattern Recognition, Proceedings of 26th ICPR Conference, Montreal, Canada, August 2022a. IAPR. URL https://hal.science/ hal-03783926.

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12. Petr Dobiáˇs, Thomas Garbay, Bertrand Granado, Khalil Hachicha, and Andrea Pinna. Comparative Study of Scheduling a Convolutional Neural Network on Multicore MCU. In DASIP 2022 - 15th International Workshop on Design and Architecture for Signal and Image Processing, volume 13425 of Lecture Notes in Computer Science, pages 69–80, Budapest, Hungary, June 2022. Springer Inter- national Publishing. doi: 10.1007/978-3-031-12748-9 6. URL https://hal.science/hal-03772221.

13. Fouad Aouinti, Stefan Bornhofen, and Aymeric Histace. Medical NER for French Language. In Healthcare Text Analytics Conference, volume to appear of Proceedings of the 5th Healthcare Text An- alytics Conference (HealTAC), Virtual, United Kingdom, June 2022. URL https://hal.science/ hal-03694764.

14. Jordane Lorandel, Mohamed Amine Khelif, and Olivier Romain. A Low-cost Hardware Attack Detec- tion Solution for IoT Devices. In The 31st IEEE International Symposium on Industrial Electronics (ISIE), Anchorage, United States, June 2022a. URL https://hal.science/hal-03715556.

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ICI

Information
Communication
Imaging

General presentation

The ICI team's research focus is on wireless communications, information theory, signal processing and imaging. The team has the unique characteristic to cover the whole scientific and technical spectrum from fundamental theory to wireless system design as well as specialized signal processing topics in the area of imaging; the profile of the team ICI largely aligns with section 7 of the CNRS but also touches upon aspects of section 6.

There are several interfaces between the research conducted by the team ICI and other teams in ETIS. In particular, a new collaboration was started between the ICI and NEURO team on the topic of robust information storage using rank-order neural codes (C. Weidmann, A. Pitti, M. Quoy), leading to a publication in the prestigious journal PNAS. Moreover, a new collaboration on quantum error correction was started with another laboratory affiliated with CY Tech, the LPTM (Laboratory of Theoretical Physics and Modelling), between I. Andriyanova and prof. Andreas Honecker.

Overall, the research topics covered by the ICI group lie primarily in the following domain areas:

- Wireless communications, B5G and 6G, including machine learning for communications, resource allocation, low energy / latency, localization, mmWave, IoT, waveform design, integrated communication and sensing.

- Security for wireless communications and B5G, including physical layer security, covertness, physical unclonable functions / biometric authentication, lattice and code-based post-quantum cryptography, privacy, intrusion detection in IoT networks.

- Coding and information theory including graph codes (e.g., LDPC), polar codes and lattices, interplay between information theory and game theory, strategic communications.

- Networking and caching, including layer 2 scheduling, energy efficient protocols, enhanced mobile broadband (eMBB) and ultra-reliable low latency communications (URLLC) coexistence.

- Imaging and modeling: inverse problems, new tomography concepts and modern challenges in imaging.

This year saw the departure of two colleagues (V. Belmega, MCF HDR, promoted to Professor at ESIEE Paris, and M. Le Treust, CR CNRS, who requested a transfer to the IRISA lab in Rennes).

A new lecturer, Dr. Luan CHEN (MCF at ENSEA) was recruited to reinforce the research area of wireless communications. He brings to the team a new expertise in localization techniques, sensor networks and eHealth.

Synthesis of the research activities in 2022

The ICI group produced 19 International Refereed Journals and 20 Refereed International Conference Papers, including top IEEE journals, e.g. IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, IEEE Transactions on Information Theory, IEEE Transactions on Vehicular Technology, as well as PNAS and Inverse Problems and Imaging, and IEEE conferences such as ICC, GLOBECOM, ISIT, ITW, SPAWC, and the cryptography conference Asiacrypt, IEEE Nuclear Science Symposium and Medical Imaging, IEEE/ACM-Signal Image Technology and Internet-Based Systems.

Highlights in 2022

The international and national outreach of the team continues to increase as evidenced by:

- The ICI team was invited to take part in several coordinated projects of the PEPR 5G (PC3, PC4, PC5, PC6, PC7, PC8), under the CNRS banner, for a total budget of 1 240k€. The project will start in May 2023, and will involve the creation of the NextGenCom platform (ICI-CELL) at ETIS.

- A. Chorti contributed the sections on 6G trustworthiness in the International Telecommunication Union Report ITU-R M.2516-0 (11/2022) on "Future technology trends of terrestrial, International Mobile Telecommunications systems towards 2030 and beyond".

- V. Belmega obtained the Top 5 papers recognition of the IEEE Trans. on Smart Grids, paper co-authored with Dr. S. Laksminarayana and Prof. V. H. Poor (out of more than 1000 papers in the last 3 years)

- Maël Le Treust successfully defended his HDR thesis, "Coordination et Communication Stratégique"

- 5 PhD theses were defended

KPI of ICI in 2022

Members

As of 31st December 2022, the ICI Group has:

- 10 permanent members:
    - 4 Full Professors
    - 5 Assistant Professors
    - 1 Full CNRS Researchers – CR
- 16 non-permanent members:
    - 6 associates (Marwa Chafii, Rachid Chelouah, Astrid Jourdan, Lylia Alouache, Kévin Carrier, Veronica Belmega)
    - 9 PhD Students registered at the ED of CYU
    - 1 postdoctoral researcher

Publications

Journal	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
21	21	8		0	0	0	5	

Publications with others teams of ETIS

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
2	2	0	0	0	0	0	1	0

HDR Defended

- M. Le Treust, HDR CY Cergy Paris UniversiteÃÅ, "Coordination et Communication StrateÃÅgique" 29 november 2022

Ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
ALI	ANDRIYANOVA	ECOBIOH2	ED – ADEME	11/02/2019	Energy-aware Green Data Center Network and Job Scheduling
AWADA	CHORTI, BERRI	-	ED	01/10/2022	Modeling network slicing in 5G and beyond networks
AYAD	NGUYEN-VERGER	AGM CY	DIM Math INNOV	2021	Apports de l'intelligence artificielle, modélisation mathématique et optimisation en imagerie
BEN ATIA	BELMEGA, SAVARD, NEGREL	IMT Lille ESIEE	ED	21/07/2020	cooPeration, Optimization and arTificial Intelligence for future communicatiONs: interplay between model-based and data-driven approacheS
BOUETTE	WANG LUZZI	-	INEX - PHEBE	01/11/2021	Information and coding-theoretic study of covert communication
EL KADERI	ANDRIYANOVA	LPTM	ED	01/09/2022	Algorithmics and noise modeling for quantum devices
MALEKI	BELMEGA LAKSHMINARAYANA	WARWICK	EUTOPIA COFUND WALL-EE	11/11/2021	Wide-area Adaptive control in InteLLigent cyber-physical power systems exploiting dEEP reinforcement learning
ROSSEEL	FIJALKOW SAVIN	CEA	ED - CEA	05/10/2020	POWER EFFICIENT AI-BASED IOT PHYSICAL LAYER
SBEITY	BELMEGA	CEA	CEA	01/10/2021	Deep Wireless Localization based on Artificial Intelligence for Challenging Environments

Interteam ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
DESPORTES	FIJALKOW ANDRY	ECOBIOH2	ED - ADEME	09/10/2018	Learning, Forecasting and optimization of energy supply for a low environmental impact building

PhD Defended

Name	Supervisor	Partner	Type	Start	Defended	Length	Title
SALIBA	FIJALKOW LUZZI	-	ED - INEX	28/09/2017	24/05/2022	4.5 years	Lattice hash functions for secret key generation.
DESPORTES	FIJALKOW ANDRY	ECOBIOH2	ED - ADEME	09/10/2018	16/12/2022	4 years	Learning, Forecasting and optimization of energy supply for a low environmental impact building
BOU ROUPHAEL	FIJALKOW LE TREUST	-	INEX - COSA	01/10/2019	01/12/2022	3 years	Strategic Coordination of Autonomous Devices: Interplay between Information Theory and Game Theory
BELLO	FIJALKOW CHORTI	-	ED	01/11/2019	14/12/2022	3 years	Meeting delay and security constraints in sixth generation (6G) wireless networks
EL HASSANI	BELMEGA SAVARD	IMT Lille	ED – ANR Eliot	01/10/2019	2/12/2022	3 years	Energy-efficient IoT networks

Overview of contracts

- ANR: 2 with ETIS as leader (1 PRCI, 1 JCJC), 1 with ETIS as participant (1 PRCE)
- 1 PIA3 (ADEME)
- 4 INEX + 1 chaire INEX
- EUTOPIA COFUND: 1 (new)
- 3 DIM (1 new)
- 1 PHC
- 1 DigiCosme

New contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
AAP IEA USA	CNRS	INS2I	CHORTI	01/02/2022	11 months	7000	7000 €
PHC MAIMONIDE 2eme année	CNRS	Ministère	WANG	01/02/2022	1 year	11000	11000 €
DECODE	CY	ANR	CARRIER	01/10/2022	42 months	162 600 €	183 738 €
PEGASUS	CNRS	IEA	CHORTI	1/1/2021	2 years	14 000 €	
PEPR 5G	CNRS		FIJALKOW		5 years	1 200 000	-

			ANDRIYANOVA CHORTI				
PHC PROCOPE		Ministère	CHORTI	1/1/2021	2 years	20 000 €	-
SRV ENSEA PUC-Rio	ENSEA	SRV	CHORTI	2022	4 years	-	-
PHC GERMAINE DE STAËL		Campus France	WANG	1/1/2022	2 years	-	4800€

Ongoing contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
AI4CODE	CY	ANR	ANDRIYANOVA	01/10/2021	48 months	80 239 €	80 239 €
AYAS	DIM Math INNOV	Thesis	NGUYEN-VERGER	2021	3 years	118.620 € (CY)	-
WALL-EE	EUTOPIA	COFUND	BELMEGA	2021	4 years	71k GBP + 9.9k GBP for mobility (Warwick)	
POTIONS	ENSEA	CONTRAT DOCTORAL	BELMEGA	01/10/2020	3 years	93 000€	93 000€
CEA TECH	ENSEA	PhD	FIJALKOW	19/10/2020	3 years	0 €	0 €
QCSP	ENSEA	ANR	LUZZI/GHAFFARI	01/10/2019	4 years	787 608€	80 k€ (Cf CELL)
ELIOT	ENSEA	ANR + FAPESP	BELMEGA	01/11/2018	4.5 years	390 420€	390 420€
ECOBIOH2	ENSEA	ADEME	FIJALKOW	17/05/2018	84 months	580 149€	457 708€
CHAIRE ASIA	ENSEA	INEX AAP CHAIRE	CHAFII	01/09/2018	4 years	216 000€	216 000€
Co-financement projet EcobioH2	ENSEA	DIM RFSI	FIJALKOW	1/04/2021	3 years	2 100€	3 181€
COSI	ANR	PhD	WANG	30/11/2020	42 months	158 220€	158 220€
PHEBE	INEX	PhD	WANG	01/07/2020	4 years	1 919 381 €	391 500 €
eNiGMA	INEX	Post-Doc	CHORTI	01/01/2020	2.5 years	287 137€	112 00€
COSA	INEX	Doctorant Roni Bou Rouphael	Le TREUST	01/10/2019	3 years	403 724 €	117 500 €
ECOMICENE	DigiCosme – INRIA	Thesis	WEIDMANN	01/11/2017	46 months	145 000€	0 €
PHC MAIMONIDE 1ère année	Campus France	Travels	WANG	27/03/2020	9 months	11 000€	11 000 €
MONTUS		Eramus+ Capacity Building	D. LAFFLY (UT2J) JOURDAN	2019	3 years (+1 year Covid)	1M€ (global) 124 995€ (EISTI/CYU)	0 €

MONTUS		Eramus+ Capacity Building	D. LAFFLY (UT2J) JOURDAN	2019	3 years (+1 year Covid)	1M€ (global) 124 995€ (EISTI/CYU)	0 €

Scientific Dissemination

Event Organization

- *A. Chorti was co-chair of the IEEE WCNC Workshop on Trusted Communications with Physical layer security*
- *A. Chorti was chair of the Future Networks World Forum '22 special session on Physical layer Security for 6G*
- *M. K. Nguyen organized the research Committees of the Club EEA, Intelligence artificielle : vue d'ensemble, objectifs et défis " (06/04/2022) and " Développement durable: Géothermie " (01/12/2022)*

Invited Professors

- *Rodrigo de Lamare, PUC-Rio, Brazil, visiting E. Belmega, February-March 2022*
- *Matthieu Bloch, Georgia Tech, visiting L. Wang, L. Luzzi and M. Le Treust, one week in May 2022*
- *Javier Cebeiro, Centro de Matematica Aplicada (CEDEMA), Universidad Nacional de San Martin, Buenos Aires, Argentina, visiting M. K. Nguyen, 1 month in July 2022*

Guest and Associate Editors

- *M. Le Treust and L. Wang were Associate Editor for* IEEE Transactions in Information Theory
- *V. Belmega is Area Editor for the IEEE Trans. on Machine Learning in Communications and Networking*
- *V. Belmega was Co-Lead Guest Editor of the IEEE IoT Magazine Special Issue: "Pervasive, Efficient and Smart Signal Processing for IoT"*
- *L. Chen is Consulting Associate Editor for IEEE Open Journal of Signal Processing*
- *A. Chorti was Associate Editor in Chief of the* IEEE ComSoc Best Readings *and Associate Editor of the* IEEE Open Journal of Signal Processing (OJSP)

TPCs

- *I. Andriyanova was TPC for the International Conference on Communications (ICC) and for the Global Communications Conference (GLOBECOM)*
- *V. Belmega was TPC of IEEE SPAWC, IEEE WCNC, IEEE PIMRC, and IEEE Future Networks World Forum*
- *A. Chorti was 2022-2023 Co-Chair of the IEEE ICC 2023 Wireless Communications Symposium, and Track chair of the IEEE Future Networks World Forum 2022*
- *L. Luzzi and L. Wang were TPCs for the* IEEE Information Theory Workshop (ITW)
- *I. Andriyanova and M. Le Treust were TPCs for the* IEEE International Symposium on Information Theory (ISIT)

Prizes and distinctions

- *V. Belmega obtained the Top 5 papers recognition of the IEEE Trans. on Smart Grids, paper co-authored with Dr. S. Laksminarayana and Prof. V. H. Poor (out of more than 1000 papers in the last 3 years)*

- *A. Chorti obtained a CRCT semester from section CNU 27*

National and local scientific responsibilities

- *V. Belmega DUA (Deputy Director) of ETIS until September 2022*

- *I. Andriyanova is the Director of the Département des Sciences Informatiques (Institut ST)*

- *I. Andriyanova and M. K. Nguyen are members of the Conseil d'Etablissement of CY Tech, CY Cergy Paris University*

- *A. Chorti and I. Fijalkow were members of the HCERES National Evaluation Committee for the Laboratories IRIMAS, Haute Alsace and LIS, Marseille*

- *A. Chorti was a Member of the Best Thesis Prize Committee of GdR ISIS / Gretsi / EEA*

- *A. Chorti was a member of the steering committee of the Pole Systematic*

- *L. Chen is a member of the "Systematic - Digital Infrastructure & IoT Hub"*

- *I. Fijalkow is the President of Section 7 of CoNRS*

- *I. Fijalkow is a member of the Conseil de Développement of Cergy-Pontoise*

- *M. Le Treust is Scientific Secretary of the Conseil Scientifique d'Institut of INS2I*

- *M. K. Nguyen is Vice-President of the Commission de Recherche and member of the Conseil d'Administration of Club EEA.*

- *M. K. Nguyen is a member of the PhD Thesis Prize Organization Committee of the Club EEA, the GDR-ISIS and GRETSI.*

- *M. K. Nguyen is a member of the Computer Science Department Council, CYU.*

International scientific responsibilities

- *V. Belmega is a Member of the IEEE SPCOM Technical Committee*

- *A. Chorti chairs the IEEE Focus Group on Physical Layer Security*

Invited Talks

- *V. Belmega, Invited Talk at IEEE ICC : WS-19 Workshop on E-Health security for future 6G, zoom, "Non-cooperative game theory and its applications in security for wireless communications", May 2022*

- *V. Belmega, Invited Talk at PUC-Rio, Rio de Janeiro, Brazil, "Online convex optimization in wireless networks and beyond: The feedback-performance trade-off", Dec. 2022*

- *A. Chorti, Keynote Speaker at the ICC Workshop on (the Role of) PHY layer Security (PHY-Sec) for Future 6G-enabled Health Applications: E-health Security for Future 6G, "Context awareness as an enabler of physical layer security for 6G wireless", organizer: E. Jorswieck, May 2022*

- *A. Chorti, Panelist at the NYU Wireless Workshop panel on "Can 6G Deliver its Promise While Offering Security, Resiliency, and Trustworthiness?", chaired by M. Gosh; co-panelists M. Bloch and B. Hochwald, organizers: T. Marzetta, E. Erkip, L. Van der Perre and P. Popovki, Oct. 2022*

- *A. Chorti was a Panelist at the Hub Digital Infrastructure & IoT Systematic IdéO #4 – Santé connectée on "Comment faire face aux enjeux/contraintes de sécurité ?", chaired by B. Helfre, Oct. 2022*

- *A. Chorti, Invited Speaker, Barkhausen Institut, "A roadmap for incorporating physical layer security in 6G: why it is needed and how we will do it", host: G. Fettweis, Feb. 2022*

- *A. Chorti, Invited Speaker, Dep. of Electrical and Computer Engineering, New York University, "A roadmap for incorporating physical layer security in 6G: why it is needed and how we will do it", host: E. Erkip, April 2022*

- *A. Chorti, Invited Speaker, Dep. of Electrical and Electronic Engineering, Princeton University, "A roadmap for incorporating physical layer security in 6G: why it is needed and how we will do it", host: H.V. Poor, April 2022*

- *A. Chorti, Invited Speaker at the Online Nokia Bell Labs Seminars Series, "Context aware 6G security incorporating the physical layer", organizers: D. Schoinianakis, Y. Miche, P. Sehier, June 2022*

- *A. Chorti, Invited Speaker at 6G-RIC EuCNC 2022, "Context aware 6G security incorporating the PHY", organizer: S. Stanczak, June 2022*

- *A. Chorti Invited Speaker, Technology Innovation Institute (TII) Telecom Seminars, "A roadmap for incorporating physical layer security in 6G: why it is needed and how we will do it", organizers: D. B. Costa, M Debbah, C.-F. Bader, June 2022*

- *A. Chorti, Invited Speaker at the FIC - Forum International de la Cybersécurité 2022, "Context aware security: the role of the physical layer", representing the CNRS in the 5G Masterclass, June 2022*

- *A. Chorti, Invited Speaker on "Incorporating Physical layer Security in 6G Security" at the 2022 IEEE SPS - EURASIP Summer School "Defining 6G: Theory, Applications, and Enabling Technologies", organizers: E. Larsson, N Pappas, Y. Cheng, Aug. 2022*

- *M. K. Nguyen, « Some generalized Radon Transforms inspired from imaging technology", International Conference "Inverse Problems: Modeling and Simulation" (IPMS), Malta, May 22-28, 2022 (Invited Talk).*

Research perspectives for 2023

The ICI group's research focus will continue to be on wireless communications, information theory, signal processing and imaging, opening also up to new topics, indicatively:

- integrated communications and sensing (eHealth, localization)
- semantic communications
- privacy and trustworthiness for 6G (mathematical theory of trustworthiness)
- code-based cryptography, lattice based signatures
- quantum error correction
- energy efficient networking, spike modulation, neuromorphic neural networks
- imaging and modeling: data-driven approach and contributions of artificial intelligence in imaging

Publications 2022

Journals

1. *A. Yardi, T. Benaddi, C. Poulliat and I. Andriyanova, "EBP-GEXIT Charts for M-Ary AWGN Channel for Generalized LDPC and Turbo Codes," in IEEE Transactions on Communications, vol. 70, no. 6, pp. 3613-3626, June 2022, doi: 10.1109/TCOMM.2022.3167027.*

2. I. Chafaa, R. Negrel, E.V. Belmega, and M. Debbah, "Self-supervised deep learning for mmWave beam steering exploiting sub-6 GHz channels", IEEE Trans. on Wireless Commun., vol. 21, no. 10, pp. 8803-8816, May 2022.

3. E.V. Belmega, D. Ciunzo, M. Debbah, L. Lampe, D-T. Phan Thuy, T. Routtenberg, and C. Yuen, "Pervasive, Efficient, and Smart Signal Processing for IoT", Guest Editorial, SI of the IEEE IoT Magazine, Dec. 2022.

4. S. Berri, J. Zhang, B. Bensaou, and H. Labiod, Preserving Location-Privacy in Vehicular Networks via Reinforcement Learning, IEEE Transactions on Intelligent Transportation Systems, vol. 23, no. 10, pp.18535-18545, 2022.

5. K. Hijja, S. Berri, and H. Labiod, Network Slicing with Load-Balancing for Task Offloading in Vehicular Edge Computing ", Elsevier Vehicular Communication, pp. 1-16, vol. 34, 2022.

6. S. Berri, J. Zhang, B. Bensaou, and H. Labiod, Joint Content-prefetching, Transmission Scheduling, and Rate Adaptation in Vehicular Networks, IEEE Transactions on Vehicular Technology, vol. 71, no. 4, pp.4348-4358, 2022.

7. M. Mitev, M. Shakiba-Herfeh, A. Chorti, M. Reed and S. Baghaee, "A Physical Layer, Zero-Round-Trip-Time, Multifactor Authentication Protocol," in IEEE Access, vol. 10, pp. 74555-74571, 2022, doi: 10.1109/ACCESS.2022.3187967.

8. A. Chorti et al., "Context-Aware Security for 6G Wireless: The Role of Physical Layer Security," in IEEE Communications Standards Magazine, vol. 6, no. 1, pp. 102-108, March 2022, doi: 10.1109/MCOMSTD.0001.2000082.

9. S. Skaperas, N. Ferdosian, A. Chorti and L. Mamatas, "Scheduling of Heterogeneous Services by Resolving Conflicts," IEEE Access, vol. 10, pp. 36576-36591, 2022, doi: 10.1109/ACCESS.2022.3163388.

10. B. Su, W. Yu, H. Liu, A. Chorti and H. V. Poor, "Secure Transmission Design for Cooperative NOMA in the Presence of Internal Eavesdropping," IEEE Wireless Communications Letters, vol. 11, no. 5, pp. 878-882, May 2022, doi: 10.1109/LWC.2021.3098935.

11. M. Mitev, M. M. Butt, P. Sehier, A. Chorti, L. Rose and A. Lehti, "Smart Link Adaptation and Scheduling for IIoT," IEEE Networking Letters, vol. 4, no. 1, pp. 6-10, March 2022, doi: 10.1109/LNET.2022.3144733.

12. G. A. N. Segura, A. Chorti and C. B. Margi, "Centralized and Distributed Intrusion Detection for Resource-Constrained Wireless SDN Networks," IEEE Internet of Things Journal, vol. 9, no. 10, pp. 7746-7758, 15 May15, 2022, doi: 10.1109/JIOT.2021.3114270

13. J. Rosseel, V. Mannoni, I. Fijalkow and V. Savin, "Decoding Short LDPC Codes via BP-RNN Diversity and Reliability-Based Post-Processing," in IEEE Transactions on Communications, 2022, doi: 10.1109/TCOMM.2022.3218821.

14. H. Zayyani, F. Oruji, I. Fijalkow, " An Adversary-Resilient Doubly Compressed Diffusion LMS Algorithm for Distributed Estimation", Circuits, Systems, and Signal Processing 41 (11), 6182-6205, 2022

15. A. K. Gizzini and M. Chafii, "Low Complex Methods for Robust Channel Estimation in Doubly Dispersive Environments," in IEEE Access, vol. 10, pp. 34321-34339, 2022, doi: 10.1109/ACCESS.2022.3162928.

16. A. K. Gizzini and M. Chafii, "A Survey on Deep Learning Based Channel Estimation in Doubly Dispersive Environments," in IEEE Access, vol. 10, pp. 70595-70619, 2022, doi: 10.1109/ACCESS.2022.3188111.

17. R. Vehkalahti, L. Luzzi, The DMT of Real and Quaternionic Lattice Codes and DMT Classification of Division Algebra Codes, IEEE Transactions on Information Theory, vol 68, n. 5, pp. 2999-3013, May 2022

18. C. Tarpau, J. Cebeiro, G. Rollet, M. K. Nguyen and L. Dumas, « Analytical reconstruction formula with efficient implementation for a modality of Compton scattering tomography with translational geometry», Inverse Problems and Imaging, 16(4), pp771, 2022. doi:10.3934/ipi.2021075.

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20. A. Pitti, C. Weidmann, M. Quoy, "Digital computing through randomness and order in neural networks", Proceedings of the National Academy of Sciences of the United States of America (PNAS), National Academy of Sciences, 2022, 119 (33)

21. A. Pitti, M. Quoy, C. Lavandier, S. Boucenna, W. Swaileh, C. Weidmann, "In Search of a Neural Model for Serial Order: a Brain Theory for Memory Development and Higher-Level Cognition", IEEE Transactions on Cognitive and Developmental Systems, 2022, pp. 1-12.

International conferences

1. L. Alouache, T. Sylla, L. Mendiboure, H. Aniss, A Fuzzy approach for load balancing in Blockchain-based Software Defined Vehicular Networks, 18th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob), pp. 235-242, October 2022

2. L. Alouache, S. Yassa, A. Ahfir, A Multi-objective Optimization Approach for SDVN Controllers Placement Problem, 13th International Conference on Network of the Future (NoF) (pp. 1-9), October 2022

3. A. Maalaoui, C. Poulliat and I. Andriyanova, "Geometric versus Probabilistic Shaping for Circular-QAM with Nonbinary LDPC Codes," IEEE International Symposium on Information Theory (ISIT), Espoo, Finland, 2022, pp. 396-401, doi: 10.1109/ISIT50566.2022.9834656.

4. I. Andriyanova and C. Poulliat, "Analysis of Non-Binary High-Rate Repetition-Parity-Parity Codes Over the BEC," IEEE International Symposium on Information Theory (ISIT), Espoo, Finland, 2022, pp. 1169-1174, doi: 10.1109/ISIT50566.2022.9834620.

5. J. Rey-Jouanchicot, J.A. Lorenzo Del Castillo, S. Zuckerman, and E.V. Belmega, "Energy-efficient online resource provisioning for cloud-edge platforms via multi-armed bandits", Workshop on Cloud Computing, IEEE SBAC-PAD Workshops, Bordeaux, France, Nov. 2022.

6. H. El Hassani, A. Savard, E.V. Belmega, and R. C. de Lamare, "Energy-Efficient Solutions in Two-user Downlink NOMA Systems Aided by Ambient Backscattering", IEEE GLOBECOM, Rio de Janeiro, Brazil, Dec. 2022.

7. E.V. Belmega, P. Mertikopoulos, and R. Negrel, "Online convex optimization in wireless networks and beyond: The feedback - performance trade-off", invited paper at RAWNET international workshop in conjunction with WiOpt, Turin, Italy, Sep. 2022.

8. Y. Benatia, R. Negrel, A. Savard, and E.V. Belmega, "Robustness to imperfect CSI of power allocation policies in cognitive relay networks", IEEE SPAWC, Oulu, Finland, Jul. 2022.

9. Y. Benatia, A. Savard, R. Negrel, and E.V. Belmega, "Unsupervised deep learning to solve power allocation problems in cognitive relay networks", IEEE ICC, Workshop on Data Driven Intelligence for Networks and Systems (DDINS), Seoul, South Korea, May 2022.

10. K. Carrier, T. Debris-Alazard, C. Meyer-Hilfiger, J.-P. Tillich, "Statistical Decoding 2.0: Reducing Decoding to LPN", Asiacrypt 2022

11. N. Ferdosian, S. Berri and A. Chorti, "5G New Radio Resource Allocation Optimization for Heterogeneous Services," International Symposium ELMAR, 2022, pp. 1-6, doi: 10.1109/ELMAR55880.2022.9899817.

12. M. Srinivasan, S. Skaperas, M. Shakiba-Herfeh and A. Chorti, "Joint Localization-based Node Authentication and Secret Key Generation," IEEE International Conference on Communications, 2022, pp. 32-37, doi: 10.1109/ICC45855.2022.9838952

13. G. Alkhoury, S. Berri, A. Chorti, "Task Offloading with 5G Network Slicing for V2X Communications", IEEE Global Communications Conference (Globecom) Dec. 2022, Rio, Brazil

14. S. Ehsanfar, K. Moessner, A. K. Gizzini and M. Chafii, "Performance Comparison of IEEE 802.11p, 802.11bd-draft and a Unique-Word-based PHY in Doubly-Dispersive Channels," 2022 IEEE Wireless Communications and Networking Conference (WCNC), Austin, TX, USA, 2022, pp. 1815-1820, doi: 10.1109/WCNC51071.2022.9771810.

15. N. Charpenay, M. Le Treust, A. Roumy, "Zero-error source coding when side information may be present", International Zürich Seminar on Information and Communication, March 2022

16. R. Bou Rouphael and M. Le Treust, "Strategic Communication with Cost-Dependent Decoders via the Gray-Wyner Network", IEEE Information Theory Workshop 2022

17. *C. Saliba, L. Luzzi, C. Ling, "Error Correction for FrodoKEM Using the Gosset Lattice", International Zurich Seminar on Information and Communication, March 2022*

18. *I. Ayad, C. Tarpau and M. K. Nguyen « Tomographic image reconstruction from incomplete data via a hybrid GAN», IEEE Nuclear Science Symposium and Medical Imaging Conference 2022 (IEEE NSS/MIC'22), Milano, Italy, 05th-12th November 2022.*

19. *I. Ayad, C. Tarpau, J. Cebeiro and M. K. Nguyen « Tomographic reconstruction from sparse-view and limited-angle data using a generative adversarial network», 16th International Conference on Signal Image Technology and Internet-Based Systems (IEEE/ACM-SITIS), Dijon, France, October 19– 21, 2022.*

20. *H. Rao and L. Wang, "An Extensible Covert Communication Scheme Over the AWGN Channel With Feedback," IEEE Information Theory Workshop, Mumbai, India, 1–9 Nov. 2022.*

21. *S. Ma, S. M. Moser, L. Wang, and M. Wigger, "Signaling for MISO Channels Under First- and Second-Moment Constraints," IEEE International Symposium on Information Theory, Espoo, Finland, 26 Jun.–1 Jul. 2022.*

National conferences

1. *A. Savard, and E.V. Belmega, "Achievable rate regions for cooperative cognitive radio networks with complex channels and circular normal additive noises", Actes du GRETSI, Nancy, France, Sep. 2022.*

2. *H. El Hassani, A. Savard, E.V. Belmega, **et R.C. de Lamare , "Rétrodiffusion coopérative efficace en énergie pour un système multi-utilisateurs à accès multiple NOMA", Actes du GRETSI, Nancy, France, Sep. 2022.***

3. *M. Bello, A. Chorti, I. Fijalkow, "On the MAC layer Optimal Power Allocation in NOMA Uplink Networks", GRETSI Sep. 2022, Rennes*

4. *A. Chorti, D. Picard, "Achievable Rates and Machine Learning Detection of Faster than Nyquist Spectrally Efficient FDM", GRETSI, Sep. 2022, Rennes*

5. *J. Rosseel, V. Mannoni, V. Savin, I. Fijalkow, "Décodeurs BP-RNNs mis en parallele et spécialisés dans le décodage de codes LDPC courts", GRETSI 2022*

6. *A. Jourdan, "Plans d'expériences pour mélanges avec une distribution de Dirichlet", 53èmes Journées de Statistique SFdS 2022 - Lyon, Juin 2022*

7. *N. Charpenay, M. Le Treust**, A. Roumy, "Codage de source zéro-erreur pour un réseau de Gray-Wyner lorsque l'information adjacente peut être présente", GRETSI Nancy 2022***

8. *R. Bou Rouphael, M. Le Treust**, "Communication stratégique via le réseau de Gray-Wyner", GRETSI Nancy 2022***

Science and society

1. *V. Belmega, Member of the IEEE SPS Women In Signal Processing Subcommittee - Grade Elevation, Nomination and Awards*

2. *V. Belmega, Visites Insolites du CNRS, ETIS/ENSEA, Demo "Partager ou Rafler : La théorie des jeux en direct", Oct. 2022*

3. *A. Chorti, I. Fijalkow and S. Berri: round table organisation and moderation on gender Equality, Inclusion and Diversity at GRETSI*

4. *C. Bouette, A. Chorti, L. Luzzi, and I. Fijalkow were interviewed for the booklet "ETIS - 10 Inspiring Women of Science – Portraits de Femmes Scientifiques"*

5. *I. Fijalkow participated to CISCO Connected Girls, a round table and workshop for high school students, February 2022*

6. *C. Weidmann, interactive installation "Specchio connesso", presented at the Art and Science festival "Teatri del suono/Soglie", Trieste (Italy), October 14-22, 2022.*

7. *A. Jourdan co-organized the conference and round table "Qui contrôle l'IA?" (online), May 20, 2022*

8. *A. Jourdan co-organized the round table "IA et Quantique", CY Tech campus in Pau, September 22, 2022.*
9. *A. Jourdan co-organized two data challenges on IA for students with CapGemini, SurfRider, API Conseil et Tatami, January and April 2022*

MIDI

Multimedia
Indexing
Data
Integration

General presentation

The MIDI team (Multimedia Indexing and Data Integration) was created in 2006 with the fusion of two previously existing teams, one working on databases and one working on image processing. The team consists of about a dozen of permanent faculty members (teachers-researchers) and includes the research activity of 2 Research Engineers, members of the Pole Ingénierie in the new organization of ETIS. The team is distributed between ENSEA (3 permanent teachers-researchers), and CY Cergy Paris Université, site St. Martin. With the integration of the EISTI engineering school within CY Cergy Paris Université, effective in 2020, two associated members from EISTI have integrated the team and a new member was recruited by EISTI in 2019 in the MIDI team. Also, a few members of the team are participating to the IDHN research federation, composed by members of ETIS and of several social and human sciences laboratories of CY Cergy Paris Université. The goal of IDHN is to exploit diverse data corpuses (text, social media, multimedia) for various applications in social and human sciences.

The team, which was traditionally working around two distinct axes of research, (1) indexing and searching of multimedia data, and (2) big data management and data analytics, is moving toward a more integrated team. This convergence process is based on the wide adoption of machine learning / artificial intelligence methods for both data engineering and data analytics tasks, but also on the multitude of data modalities that need to be analyzed in modern AI applications ranging from text, images and video to graphs and tabular data. The high-level MIDI research objective is to bridge the gap between two until recently siloed research areas namely data engineering and AI and to study novel data processing and modeling techniques that respect various constraints (e.g., on the fly, fairness-privacy preserving or with a low footprint)?. In this more integrated perspective, the team activity can be divided in three main research areas:

1. Data Integration and Analytics for multiple modalities. This includes work on massive data integration, in particular of linked and streaming data, on analysis and mining of social networks, for both the text content and the graph structure, on analysis of mobility and spatiotemporal data, and on the indexing, analysis and content-based search of visual content.

2. Distributed, Online and Deep Learning. This includes the design of specific learning methods for data-driven automated decision making, for instance deep learning approaches for computer vision applications, learning for text understanding, graph-based learning and learning for streaming data.

3. *Responsible Data Science*. This corresponds to a new direction of research in the team, toward the interpretability and explainability of machine learning algorithms, to tackle issues such as transparency and fairness of decision making based on this kind of algorithms. It also includes work on data quality and its impact on the results of machine learning algorithms, as well as various issues related to explainability and data privacy in the context of data integration.

To support the work of the team members in the long term, the team has invested in the creation of the following platforms:

1. Platform RETIN, which is implementing in one compact way the work of the team around multimedia description and analysis, multimedia classification and indexing and machine learning for multimedia search.

2. Platform MIDI cloud, a new platform in the process of becoming operational that allows the team members to push to parallel and distributed architectures parts of their research around top-k queries, graph summarization and data privacy processing. The platform is also hosting several applications in collaborative projects in the field of Cultural Heritage (SoCoRe!, DataH, ESPADON).

3. Platform ARAV3D, which is supporting research around acquisition of 3D models and virtual and augmented reality experiments. It is used for experimentation in the areas of 3D modeling, facial recognition, etc.

Finally, the MIDI team wants to begin the REMI (Responsible, Explainable, Multimodal Intelligent Systems) team in 2023 to follow the natural evolution of the MIDI themes.

Highlight

Top publications

- A. Ntroumpogiannis, M. Giannoulis, N. Myrtakis, V. Christophides, E. Simon, I. Tsamardinos. "A Meta-level Analysis of Online Anomaly Detectors". VLDB Journal January 2023.

- D. Palyvos-Giannas, K. Tzompanaki, M. Papatriantafilou, V. Gulisano. "Erebus: Explaining the Outputs of Data Streaming Queries". Proc. VLDB Endow. 16(2), 230-242 (2022)

- X. Nguyen, The Gyro-Structure of Some Matrix Manifolds, in: NeurIPS, 2022.

- X. Nguyen, A Gyrovector Space Approach for Symmetric Positive Semi-definite Matrix Learning, in: ECCV, 2022, pp. 52–68

- L. Jezequel, N-S. Vu, J. Beaudet, A. Histace, "Efficient Anomaly Detection Using Self-Supervised Multi-Cue Tasks", IEEE Trans on Image Processing 2022.

- J. Pourcel, N-S. Vu, R.-French. Online task-free continual learning with Dynamic Sparse Distributed Memory. European Conf. on Computer Vision (ECCV) 2022.

Successful applications for several projects

- ANR Expida, HORIZON ARENAS, SHIELD vs. Disinfo (ERASMUS+) coordinated by ETIS

New members

- Guillaume Renton, MCF, ENSEA (from 1st september 2022).

Synthesis of the research activity in 2022

In the first axe (Multimodal Data Integration and Analytics) we will firstly highlight the results obtained on multimodal data mining and machine learning and secondly on data integration and analytics.In the field of multi-modal machine learning, the work with ALTECA was started and first results were published on Multi-modal Clustering based on non-negative matrix factorisation [C13] and a first demonstration was done on online multimodal sentiment analysis with text, audio and video modalities. The proposed

method for unsupervised multi-modal multi-view collaboration by transferring knowledge between various local Non-negative Matrix Factorizations uses various Non-negative Matrix Factorisations (NMFs) which interact and reveal the inherent patterns and structures in data sets. Based on the multi-view data from Protext Project which represents the text burst and their characteristics, we proposed a new multi-view clustering approach using the barycentric coordinate representation. By projecting the original data points into a barycentric space and iteratively optimizing the prototypes of each cluster based on a common cluster indicator, this approach is able to discover a consensus model and performs clustering across multiple feature views. This work was done in collaboration with LORIA (Université de Nancy) by co-directing the PhD thesis of Q. Xiatong. In this axis, we finally investigate inconsistency in databases, considering that (1) data integration leads to inconsistencies, and that (2) restoring consistency is generally time consuming, if not impossible. We defined semantics in which inconsistency is dealt with as such (so-called para-consistent approach in logic), at the same level as the standard truth values 'true' and 'false'. We do so in two different formalisms, one based on four-valued logic (see [J5]) and one based on the partition semantics for relational databases (a set-theoretic database model introduced in the late 80's by N. Spyratos) (see [J6]). Our current focus is on applying our approach to 'consistent query answering', an issue that motivates important research efforts since the last two decades. This research is a collaborative work by Dominique Laurent (ETIS) and Nicolas Spyratos (Professor emeritus in the laboratory LISN, University of Paris Saclay).

In the second axe (Distributed, Online and Deep Learning) we first report the results of our empirical study [J2] regarding the effectiveness and efficiency of anomaly detectors for streaming data (i.e., of online algorithms) used to raise alerts, predict faults, and detect intrusions or threats across industries. In this work the behavior of the detectors from different algorithmic families (i.e., distance, density, tree or projection-based) is correlated with the characteristics of different datasets (i.e., meta-features), thereby providing a meta-level analysis of their performance. For text data streams, we started the PhD Thesis with FI Group on deep unsupervised machine learning of data stream representations (M. Ben-Farès) and first results on topological unsupervised learning for high dimensional text data streams was published [C13]. The proposed method simultaneously learns the representation of the stream and cluster the data in a smaller dimension space without loosing the information. We also address the most challenging scenario of continual learning for non-stationary data, i.e., online task-free learning, by proposing a new lightweight neural network called dynamic sparse distributed memory [C4] which obtains new state-of-the-art results in continual image classification. We started the PhD of A. Montmaur which will expand our research in this direction. We further consolidate our expertise on biometrics and forensics (cheapfake detection) through various publications [J4,J5,J6]. We also proposed different deep anomaly detectors for very high-dimensional data (image, videos), varying from one-class self-supervised learning [J13] to semi-(unbalanced)-supervised techniques [C2, C3]. We introduced a novel framework for building deep neural networks on matrix manifolds [C5, C15]. Based on the theory of gyrogroups and gyrovector spaces, we show that popular matrix manifolds such as Symmetric Positive Definite and Grassmann manifolds have geometric structures that share remarkable analogies with those of Euclidean and hyperbolic spaces. This allows us to create novel results by translating well-known results in Euclidean and hyperbolic geometry into corresponding results in the considered manifolds. Furthermore, this enables generalizations of different building blocks in deep neural networks to the matrix manifold setting in a principled way. The proposed framework has proven effective on a variety of machine learning tasks, i.e., human action recognition, knowledge graph completion, and question answering.

In the third axe (Responsible Data Science) we outline the results of our work on Responsible Entity Alignment (EA) aiming (a) to enrich the diversity of resolved entities (b) to ensure fairness of resolved entities and (c) to enhance the transparency of EA systems. A meta-level analysis of popular embedding methods for entity alignment [J1], based on a statistically sound methodology reveals statistically significant correlations of different embedding methods with various meta-features extracted by Knowledge Graphs (KG) and rank them in a statistically significant way according to their effectiveness across all real-world KGs of our testbed. Besides investigating interesting trade-offs in terms of methods' effectiveness and efficiency, this work allows us to study the impact of indirect forms of bias related to the structural diversity of KGs in entity resolution tasks. In this respect, an exploration-based sampling algorithm, SUSIE, that generates challenging benchmark data for EA methods appears in [C14]. SUSIE requires setting the value of a single hyperparameter, which affects the connectivity of the generated KGs. Using our large scale experimental platform, we demonstrate that state-of-the-art embeddings methods, like RREA, RDGCN, MultiKE and BERT_INT, exhibit different robustness to structurally diverse input KGs. Finally, in [C1] we propose a data stream platform, based on Apache Flink, for explaining streaming data processing and analytics. The explanations covered both results and missing (but expected) results, and can be used to provide further information of the events that triggered an alarm (abnormal output). Special emphasis was given to the constraints imposed by the edge, data streaming context, w.r.t., time and space complexity as well as the impossibility to 'replay' the queries that lead to the data analysis.

We can outline a specific activity, orthogonal to the previous three axes, in which the team makes a coordinated effort since several years, that of Cultural Heritage Data Management. The team is involved in the ESPADON EquipEx+ project (2021-2028, D. Vodislav co-leader of the WP Data) and participated this year to the first efforts for the design of the data model for the Augmented Heritage Object (key concept in ESPADON) and of the information system architecture, in the context of the PhD of Alexandra Stoleru [C12]. In the same context, we should mention the successful application of the ANR Aorum project (2022-2025), on the study of gold in painting, in which the team is involved (D. Vodislav), with the goal of integrating the data management in the ESPADON environment in this concrete use case. This is a typical example of Cultural Heritage project in which the team may participate in the next years in the context of the ESPADON project. We also mention the first contributions on the design of methods for automatic structuring of photographic collections for spatio-temporal monitoring of restoration sites (Notre-Dame cathedral), in the context of the PhD of Laura Willot [W2]. In the context of the VERSPERA project, for the 3D reconstruction of Chateau de Versailles from ancient plans, in which we explore lately the use of deep learning methods, we proposed an approach for accelerating the processing [W1] and a synthesis paper has been accepted to be published in 2023. Finally, we mention the work in the context of the PhD of Valérie Lee, on using deep learning-based techniques to estimate the sanitary condition of book collections based on photographs of the shelves [W3] <https://hal.science/ETIS-MIDI/hal-03620940v1>.

KPI of MIDI in 2022

Members

- 13 permanent members (11 members end of 2020)
  - 4 PU: D. Kotzinos (CYU), D. Vodislav (CYU), V. Christophides (ENSEA), N. Grozavu (CYU, arrived in September 2021)

- o 1 PU Emeritus: D. Laurent (CYU)
- o 7 MCF: T. Jen (CYU), T.T. Dang Ngoc (CYU), A. Tzompanaki (CYU), S. Vu (ENSEA), Xuan Son NGUYEN (ENSEA), M. Linardi (CYU, arrived in September 2021), G. Renton (arrived in September 2022)
- o 1 lecturer-researcher (HDR): Hajer Baazaoui-Zghal (CYU, CDI arrived in 2019)
- o 1 MCF-HDR : Maria Malek (CYU, permanent member in December 2022)
- 28 non-permanent members
  - o 5 associated researchers: N. Priniotakis (CYU), Redouane Bouhamoun (CYU, CDD Tenure Track), H. Tabia (IBISC UPS until December 2022), Yiru Zhang (CYU, MCF CDD), Maroua Kotti Masmoudi (CYU, MCF)
  - o 20 PhD students and 3 in collaboration with CELL
  - o 2 postdoctoral students (M. Thamer, M. Jafar)
  - o 2 ATER (A. Zakaria, M. Hamidi)

Publications

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	HDR
16	16	4	7		2		1	1

Publications with others teams of ETIS

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
2	2							1

Ongoing PhD

New PhD in yellow.

Name	Supervisor	Partner	Type	Start	Title
ATTOLOU	D. Kotzinos / A. Tzompanaki	-	ED	01/10/2020	Explanations for missing recommendations provided by machine learning based recommendation systems
BACHIRI	M. Malek / Rogovschi	Université Paris Cité Université de Fès Maroc	Contrat Entreprise		Incremental multi-modal unsupervised learning for recommandation
BEN FARES	N. Grozavu	LORIA	CIFRE	15/07/2021	Unsupervised deep learning of representations for evolutionary data
CALVI	D. Kotzinos, P. de Hert	VUB	Cotutelle EUTOPIA	07/09/2021	Améliorer l'inclusivité des villes intelligentes : réinterpréter l'Analyse d'Impact relative à la Protection des Données dans le cadre du

					RGPD sous le prisme d'une approche intersectorielle selon le genre.
CHOMEL	V. Chavalerias B. Borzic	PRIME80	ED	14/11/2019	Fake news and information manipulation: how to model the propagation of false information (context, image or video) on several social networks
FOLLY	M. Malek		Enterprise	27/06/2022	Explainable opinion model extraction based on social networks analysis
GUEMBOUR	D. Kotzinos	CYU	ED CYU	01/11/2022	The process of social construction of risk: analysis of the case of development projects using automatic language processing tools
KHALAFAOUI	N. Grozavu, B. Matei	ALTECA	CIFRE	01/10/2021	Recommandation de réponse émotionnelle pour les systèmes affectifs sensibles au contexte
KISELEVA	D. Kotzinos, P. de Hert	VUB	Co-tutelle EUTOPIA	01/02/2020	Balancing IA transparency in healthcare with safety and quality
LARUE	V. Christophides / S. Vu	Ljubljana	Cotutelle EUTOPIA	13/10/2021	SADFake : Détection autosupervisée d'anomalies pour le repérage des faux documents (deepFake)
MAHMOUDI	D. Kotzinos, P. Triantafillou	Univ. Warwick	Co-tutelle INEX	01/02/2020	Artificial intelligence and machine learning for the optimisation of Big Data systems
MYRTAKIS	V. Christophides, I. Tsamardinos	Univ. Crète	Co-tutelle	01/02/2021	Nettoyage des données explicables
NAJI	H. Baazaoui	Fondation Chaptal	CIREX	03/10/2022	Worflows for e-health with deep learning based chatbot
QIAN	N. Grozavu, M. Clausel	Univ. de Lorraine	ANR	10/11/2021	Apprentissage non-supervisé interprétable de données hétérogènes multivues
RICKLIN	H. Baazaoui, V. Christophides	BOOPER	CIFRE	01/07/2022	Models for dynamic prediction and optimization of pricing strategies: for retail application
ROSSI	R. Chelouah, D. Vodislav	Canton Consulting	Half-time	20/06/2019	Analysis of legal rules in a semantic web environment
ROUSSEAU	D. Kotzinos, D. Camara	PJGN	Collaboration	01/01/2020	Identification of weak signals in massive data sets
SENTHIVEL	D. Vodislav / S. Vu, B. Borzic	PMU	CIREX	01/10/2021	Apprentissage Profond Non-Supervisé Temps Réel pour le Suivi Multi-Objets en sport
STOLERU	D. Vodislav, L. de Luca	MAP	FSP	01/12/2021	Développement d'outils de médiation technologique dédiés à la création de l'objet patrimonial augmenté

VAREILLE	V. Christophides, S. Linardie	CYU	ED	01/10/2022	Explainable deep learning models for time series analytics (classification, forecasting and anomaly detection)
WILLOT	D. Vodislav, L. de Luca, V. Gouet	MAP, LASTIG	FSP	01/10/2021	Classification automatique d'images photographiques pour le suivi spatio-temporel des chantiers de restauration

Interteam ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
BESNIER	PICARD HISTACE	VALEO	CIFRE	21/11/2019	Safety of automotive systems using Machine Learning
BERANGER	VU, KHELIF ROMAIN	Bluelinea	PhD2 IDF	01/06/2022	Radar-based human action recognition with deep learning
JEZEQUEL	VU HISTACE	IDEMIA	CIFRE	01/09/2020	Spoof detection by semi-supervised deep learning
MONTMAUR	VU HISTACE		AID DGA	14/11/2022	Continual learning for dynamic data and safe AI

PhD Defended

Name	Supervisor	Partner	Type	Start	Date of defended	Length	Title
BEN CHARRADA	H. Tabia	AUSY	CIFRE	06/05/2019	07/10/2022	40	3D Reconstruction of real environment with deep learning

New contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
AAP ETIS FOR ELLE	CNRS	INS2I	TZOMPANAKI	01/02/2022	11 months	5000€	5000€
AAP NEMESIS	CNRS	INS2I	LINARDI	01/02/2022	11 months	5500€	5500€
EXPIDA	CYU	ANR	TZOMPANAKI	01/03/2023	4 years	80 230€	80 230€
AORUM	CYU	ANR	VODISLAV	01/10/2022	3 years	63 849€	63 849€
BIO SERR INTENSCIF	CYU		BAAZAOUI	2022	2 years	25 000€	25 000€
XINA	CYU	CY Initative	MALEK	2022	2 years	20 000€	20 000€
ARENAS	CYU	HORIZON-CL2-2022-DEMOCRACY-01	NISTOR/LINARDI/LONGUI	2023	4 years	2.999.981,50€	130 000€
CLSafeAI	AID	DGA	VU	2022	3 years		60 000€

CLAM	SRV	ENSEA	VU	2022	3 years		51 000€
GNNHKG	CNRS	INS2I	Renton/Christophides	2023	6 months		3500€
SHIELS vs. Disinfo	ERASMUS+	EU	Kotzinos	2022	4 years	400 000€	100 000€

Ongoing Contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
AORUM	CYU	ANR	VODISLAV	01/10/2022	3 years	63 849€	63 849€
ESPADON	PIA3	Equipex +	VODISLAV	01/11/2021	8 years	8,4 M€	45 000 €
SAP	ENSEA	Contrat de prestation	CHRISTOPHIDES	15/06/2021	1 year 4 months	50 000€	50 000€
EUTOPIA PhD Co-tutelle A. Calvi	CYU/VUB	Thesis	KOTZINOS	01/10/2021	3 years	0€	0€
F.INICIATIVAS	CYU / FI GROUP	CIFRE	GROZAVU	15/07/2021	3 years	20 000€	16 000€
EUTOPIA PhD Co-tutelle N. Larue	CYU/Ljubljana	SFRI Thesis	CHRISTOPHIDES, VU	01/10/2021	5 years	500 299€	163 210€
FSP 2021 MEDIAPAT	Fondation des Sciences du Patrimoine	PhD	VODISLAV	01/12/2021	3 years	119 600 €	119 600 €
MAP InStoRe	CNRS	DIM	VODISLAV	03/02/2021	8 years	50 000€	50 000€
THESE KHALAFAOUI	CYU/ALTECA	PhD	GROZAVU	2021	4 years	26 400€	22 000€
PMU PhD Senthivel	CIREX CYU	INEX	BORZIC, VU	2021	3 years	737 468€	165 000€
PROJET RECHERCHE EMERGENT	ENSEA/SRV	APPEL SRV	CHRISTOPHIDES	2021	1 year	700€	700€
EMERGENCE	CY/MUSE MED	INEX	BAAZAOUI	01/07/2020	2 years	31 000€	31 000€
PJGN	PJGN	PhD	KOTZINOS	01/01/2020	2.7 years	112 000€	80 889€
INEX MUSE MED	INEX	Travels	ZGHAL-BAZAOUI	01/07/2020	2 years	31 000€	31000€

FSP 2020 CLASTER	Fondation des Sciences du Patrimoine	PhD	VODISLAV	01/11/2020 postponed to 01/10/2021	3 years	119 600€	119 600€
D4DETECTION	INEX	PhD	VU	17/01/2020	2 years	279 634€	84 000€
IDEMIA	ENSEA	CIFRE	VU	01/08/2020	3 years	147 000€	45 000€
PROTEXT	CYU	ANR	GROZAVU	21/03/2019	6 years	89 348€	82 730€
MOSCCOW	CNRS 80 PRIME	PhD	BORZIC	01/10/2019	3 years	0€	0€
AUSY	ENSEA	CIFRE	TABIA	9/05/2019	3 years	481 678€	45 000€
ProTEXT	ANR	PhD	GROZAVU	21/03/2019	3 years	89 348€	89 348€

Scientific Dissemination

Invited Talks/Seminars

1. *V. Christophides "Explainable Data Cleaning For ML Pipelines". Summer School "Responsibility of Algorithms: Societal and Environmental Issues" co-organized by the GDR RO and IA (and in cooperation with the GDR CIS, MADICS, IT Security) 21-26 May 2023.*

2. *M. Malek, Towards Explainability for Interaction Networks Analysis, ACONTA'22: First European Conference on Augmented Complex Networks - Trustworthy Analysis, Université Sorbonne Paris Nord, 1-2 December, 2022*

Event organization

1. *V. Christophides Panel Chair 22nd Int'l Conf. on the Semantic Web (ISWC), Athens, Greece, November 6-10, 2023. Panel Organization with Efi Tsamoura on NeuroSymbolic AI*

2. *V. Christophides Tutorial Chair 23nd Int'l Conf. on Web Information Systems Engineering (WISE) Biarritz, France, 30/10-3/11, 2022*

3. *N. Grozavu : co-organization with Transilvania University from Brasov and Washington State University of the 2nd International Machine Learning and Applications Summer School (https://mlass.unitbv.ro) on July 26-29, 2022, Brasov, Romania.*

Program Committee Members

1. *V. Christophides: ACM SIGMOD'23, ICDE'23, EDBT'23, DSAA'23, WISE'22. Int'l Workshop onTabular Data Analytics, co-located with SIGMOD'23*

2. *M. Linadri: ICDE'23, EDBT'23, VLDBJ (International Journal on Very Large Data Bases)*

3. *K. Tzompanaki: WISE'22, AI-ML Systems'22*

4. *M. Malek: International Conference on Complex Networks & Their Applications, 2022, First European Conference on Augmented Complex Networks - Trustworthy Analysis ACONTA) 2022, Special Session on Applying Complex Network Analysis for Cybersecurity, European Interdisciplinary Cybersecurity Conference (EICC) 2022*

5. *D. Kotzinos: AGILE, GIScience, FRCCS, ESWC, IC2S2, DASFAA, CNA, MDM*

6. *D. Vodislav: BDA 2022*

Editorial boards

M. Malek: Frontiers in Complex Systems

Steering committees

1. *V. Christophides: Member of the EDBT Association (since 2014) and of the Executive Board, Member of the MADICS Action on Human Explainable machine Learning Pipelines*
2. *D. Vodislav: Member of National Steering Committee of BDA, the French scientific community in the field of Data Management and Applications (since 2018)*

Expert in Scientific Programs

1. *V. Christophides: CY Initiative of Excellence, Fellows-in-Residence Prog 2022 (Member of the Reviewing Board)*
2. *H. Baazaoui : Expert for Crédit Impôt Recherche (CIR)*
3. *M. Malek: Membre du comité d'évaluation ANR, Programme Accompagnement Spécifique des Travaux de Recherches et d'Innovation Défense . Appel à projets ASTRID thématique Guerre Cognitive, Edition 2022.*
4. *D. Kotzinos: ERC, ANR*
5. *V. Christophides: Member of the EDBT Association (since 2014) and of the Executive Board (since 2019)*
6. *V. Christophides: Member of the Advisory Board of the MADICS Action on Human Explainable machine Learning Pipelines (since 2021)*

Local and National Scientific Responsibilities

- V. Christophides: Member of ENSEA Scientific Council, Responsible of ENSEA Student Mobility to Canada and Swiss (Euler zone)
- D. Vodislav:
  - Deputy Vice-President for Research, CYU, and Director for Research of CY Tech Engineering School (until November2022)
  - Deputy Vice-President for Research, CYU, in charge of the CY Initiative programs (after November 2022)
  - Co-responsible of the WP Data in the EquipEx+ ESPADON
  - Member of the Steering Committee of ERIHS France (European Research Infrastructure for Heritage Science representing CYU
  - Member of the Scientific Steering Committee of DIM PAMIR (Domaine d'intérêt majeur "Patrimoines matériels : innovation, expérimentation et résilience")
- K. Tzompanaki : Référente Egalité-Parité, Co-responsable Master IISC-SIC
- M. Malek : Responsable de l'option Data Science, troisième année ingénieur, CY Tech, Chargée de mission communication et rayonnement, Responsable du thème apprentissage et fouille de données complexes Encyclopédies sciences, ISTE Group, depuis mars 2022.

- H. Baazaoui: Responsable du département informatique (filières ingénieurs), Responsable de l'option Business Intelligence & Analytics, dernière année ingénieur et directrice du Master Spécialisé (MS) Business Intelligence & Analytics, CY Tech

- D. Kotzinos :
  - Member of the council of the Department of Computer Science
  - (co) responsible for:
    - Master Data Science and Machine Learning
    - Master Distributed and Intelligent Systems
    - Double Diploma with ZUST
    - Double Diploma with UoM
    - DU Big Data
    - CMI SIC

Research perspectives for 2023

A collaboration with Center for Research and Restoration of Museums of France (C2RMF) and Epitopos company was started in 2023 on the influence on climate change on historical monuments by thermal camera and monitoring of thermo-hydric sensors. A CIFRE thesis will be deposed in 2023 on this topic co-directed by N. Grozavu. Our team participates in ARENAS project, an EU HORIZON 2022 accepted project having as objective to characterize, measure and understand the role of extremist narratives in discourses that have an impact on the political and social spheres, but also on the stakeholders themselves. Several members of the REMI Team are involved in the project, specifically in Working Package 2 (WP2 - Characterization and detection of extremist narratives), where a Ph.D. thesis will get funded starting from October 2023 (supervision by: Julien Longhi, Michele Linardi, Nistor Grozavu). This research work will be in collaboration with the University of Dusseldorf and an AI company (Water of Mars), which will provide help on data annotation and crawling tasks, respectively. In the automatic detection of Extreme Narrative, we want to study the leverage of knowledge bases (e.g., ConceptNet) and the application of Sentic Computing recently adopted to characterize Hate Speech. We will also study multimodal learning approaches (where applicable), which can support the semantic characterization of Extreme Narrative.
Our collaboration with IDEMIA company is also strengthened. Two CIFRE theses on federated learning and face recognition for privacy preserving are being deposed. We are currently involved in an under-review EU project 2023 on multimodal learning with 14 partners of 7 countries as leader of WP of video recognition. Another CIFRE thesis on video multimodal learning will be deposed with NextRoad group as well. G. Renton and V. Christophides are finally involved in a INS2I project which started in 2023 studying, the effect of low-pass filtering and heterophily in knowledge graphs, and their effects in the recent development of Graph Neural Networks. A PhD thesis on Graph neural networks for human pose estimation (co-supervised by A. Histace, X.S.Nguyen and some collaborators from VUB) has also started in May 2023.

Several open challenges are driving our future research activity in the context of ML/DL Explainability. In particular, one of our research interests concerns climate change and environmental monitoring applications, where Satellite Image Time Series (SITS) analysis plays a crucial role. We observe a pressing need for monitoring agricultural areas continuously affected by weather extremes (e.g., droughts, hail, storms). Such a problem often requires users to work with limited domain knowledge (i.e., unlabeled

SITS data), adapting analysis models over different contexts. A clear example is crop mapping domain adaptation, in which experts train SITS classifiers with limited labeled datasets. Therefore, the resulting models cannot generalize well in different settings where data distribution can sensibly shift. Our research goal is to propose new DL Explainability solutions which enable users to gain relevant insights over time series data. In this sense, explanations must first permit analysts to understand the heterogeneous data characteristics (e.g., coming from disparate geographical regions) and provide hints on how to adapt the model in new contexts. Our future research wants to focus on three aspects: (I) compute data features importance wrt their causal effect on the model outcome (e.g., which is the spatiotemporal feature that causes a given instance to belong to a particular class? Which is the time lag of this cause-effect relation?) (II) Determine which architectural element in the model plays a fundamental role in the outcome (III) Compute time series concepts (e.g., synopsis of a given data type) that can permit measuring model sensitivity on specific data characteristics.

Finally, we are interested in online explanations for data streams that captures the evolving character of streaming data in predictions. In particular, we are interested in computation-ally light techniques for explaining not only the prediction of a model on a data sample but also why the predicted class may have changed in an updated, subsequent version of the predictive model. Moreover, to adapt the explanations to the user's needs and context, we aim to incorporate the domain knowledge in the explanations, by proposing preference schemes for the explanation discovery process that captures background domain knowledge and time/space/energy constraints.. We are currently planning to validate this novel explainability functionality in the context of an ongoing HORIZON project submission on human-centred and ethical development of digital and industrial technologies with UNIVERSITA DI BOLOGNA (UNIBO), Ericsson, IOTAM INTERNET OF THINGS APPLICATIONS AND MULTI LAYER DEVELOPMENT LTD (ITML) and Thales.

Finally, the MIDI Team wants to change its name in REMI team (Responsible, Explainable, Multimodal Intelligent Systems) in order to follow the natural evolution of the scientific axis.

Publications 2022

Journals

1. N. Fanourakis, V. Efthymiou, D. Kotzinos, V. Christophides. *Knowledge Graph Embedding Methods for Entity Alignment: An Experimental Review. Journal of Data Mining and Knowledge Discovery. Accepted for publication.*

2. A. Ntroumpogiannis, M. Giannoulis, N. Myrtakis, V. Christophides, E. Simon, I. Tsamardinos. "A Meta-level Analysis of Online Anomaly Detectors". VLDB Journal January 2023.

3. P.-Y. Genest, L.-W. Goix, Y. Khalafaoui, E. Egyed-Zsigmond, N. Grozavu et al. French translation of a dialogue dataset and text-based emotion detection. Elsevier Data and Knowledge Engineering, 2022, 142, pp.102099.

4. I. Ganapathi, S-S. Ali, N-S. Vu, S. Prakash, N. Werghi. A Survey of 3D Ear Recognition Techniques, ACM Computing Surveys, 2022.

5. I. Ganapathi, S-S. Ali, A. Mahmood, N-S. Vu, S. Javed, N. Werghi. Learning to Localize Image Forgery Using End-to-End Attention Network, Neurocomputing 2022.

6. S-S. Ali, I. Ganapathi, N-S. Vu, S.D. Ali, N. Saxena. Image Forgery Detection Using Deep Learning by Recompressing Images, Electronics, 2022.

7. *D. Laurent, N. Spyratos. Deductive databases in four-valued logic: rule semantics and models. Journal of Logic and Computation, In press, ⟨hal-03798012⟩*

8. *D. Laurent, N. Spyratos. Handling Inconsistencies in Tables with Nulls and Functional Dependencies. Journal of Intelligent Information Systems, 2022, 59 (2), pp.285-317. ⟨hal-03314808v3⟩Y. Zhang, S. Destercke, Z. Zhang, T. Bouadi, A. Martin et al. On computing evidential centroid through conjunctive combination: an impossibility theorem. IEEE Transactions on Artificial Intelligence, 2022, pp.1-10.*

9. *A. Pitti, M. Quoy, C. Lavandier, S. Boucenna, W. Swaileh et al. In Search of a Neural Model for Serial Order: a Brain Theory for Memory Development and Higher-Level Cognition IEEE Transactions on Cognitive and Developmental Systems, 2022, pp.1-1. ⟨10.1109/TCDS.2022.3168046⟩*

10. *D. Luvizon, D. Picard, H. Tabia. Consensus-Based Optimization for 3D Human Pose Estimation in Camera Coordinates. International Journal of Computer Vision, 2022, 130, pp.869-882. ⟨10.1007/s11263-021-01570-9⟩*

11. *A. Kiseleva, D. Kotzinos, De Hert. Transparency of AI in Healthcare as a Multilayered System of Accountabilities: Between Legal Requirements and Technical Limitation. Frontiers in Artificial Intelligence, VOLUME 5, 2022,*

12. *V. Pappas, D. Sardelianos and D. Kotzinos. Geography of the nods and population: an alternative spatial model for the estimation of the population distribution. Journal of AEIXOROS, (32), 28.*

13. *L. Jezequel, N-S. Vu, J. Beaudet, A. Histace, "Efficient Anomaly Detection Using Self-Supervised Multi-Cue Tasks", IEEE Trans on Image Processing 2022.*

14. *R. Devi, D. Mehrotra, S. A. Ben Lamine, H. Baazaoui-Zghal. Constituent vs Dependency Parsing-Based RDF Model Generation from Dengue Patients' Case Sheets. J. Inf. Knowl. Manag. 21(1): 2250013:1-2250013:25 (2022)*

15. *S. A. Ben Lamine, M. A. Dachraoui, H. Baazaoui-Zghal, Deep Learning-Based Extraction of Concepts: A Comparative Study and Application on Medical Data. Journal of Information & Knowledge Management*

16. *K. Benlamine, Y. Bennani, B. Matei, N. Grozavu, I. Falih. Collaborative Learning to Improve the Non-uniqueness of NMF. Int. J. Comput. Intell. Appl. 21(1): 2250001:1-2250001:24 (2022).*

Conference papers

1. *D. Palyvos-Giannas, K. Tzompanaki, M. Papatriantafilou, V. Gulisano. "Erebus: Explaining the Outputs of Data Streaming Queries". Proc. VLDB Endow. 16(2), 230-242, 2022.*

2. *L. Jezequel, N-S Vu, J. Beaudet, A. Histace. Anomaly Detection via Learnable Pretext Task. IEEE International Conference on Pattern Recognition (IAPR), Aug 2022, Montreal, Canada*

3. *L. Jezequel , N-S Vu , J. Beaudet , A. Histace. Semi-Supervised Anomaly Detection with Contrastive Regularization. IEEE International Conference on Pattern Recognition (IAPR), Aug 2022, Montreal, Canada*

4. *J. Pourcel, N-S. Vu, R.-French. Online task-free continual learning with Dynamic Sparse Distributed Memory. European Conf. on Computer Vision (ECCV) 2022.*

5. *X. Nguyen, The Gyro-Structure of Some Matrix Manifolds, in: NeurIPS, 2022.*

6. *M. Katsomallos, K. Tzompanaki, D. Kotzinos. Landmark Privacy: Configurable Differential Privacy Protection for Time Series. Twelveth ACM Conference on Data and Application Security and Privacy (CODASPY), Apr 2022, Baltimore, United States. Pp.179-190, ⟨10.1145/3508398.3511501⟩*

7. *P. Ntumba, V. Christophides, N. Georgantas. Scheduling of Continuous Operators for IoT edge Analytics with Time Constraints. International Conference on Smart Computing (SMARTCOMP), Jun 2022,*

8. *Y. Pollet, J. Dantan, H. Baazaoui- Zghal. Multi-factor Prediction and Parameters Identification based on Choquet Integral: Smart Farming Application. 17th International Conference on Software and Data Technologies (ICSOFT), INSTICC, Jul 2022, Lisbon, Portugal. Pp.340-348, ⟨10.5220/0011317900003266⟩*

9. *M. Naji, M. Masmoudi, H. Baazaoui-Zghal, C. Ghedira-Guegan, V. Stankovski et al. Semantic-based Data Integration and Mapping Maintenance: Application to Drugs Domain. 17th International Conference on Software Technologies, Jul 2022, Lisbon, Portugal. < hal-03771349>*

10. *E. Kiomba Kambilo, H. Baazaoui-Zghal, C. Ghedira, V. Stankovski, P. Kochovski, D. Vodislav. A blockchain-based framework for drug traceability: ChainDrugTrac. SAC '22: The 37th ACM/SIGAPP Symposium on Applied Computing, Apr 2022, Prague, Czech Republic. Pp.1900-1907. <hal-03670890>*

11. *A. Stoleru, L. de Luca, D. Kotzinos, D. Vodislav. Semantic Models for heritage objects: from conception to (everyday) usage. Poster. 5th International Conference on Innovation in Art Research and Technology, Paris, 2022.*

12. *Y. Khalafaoui, N.Grozavu, B. Matei, l.-W. Goix. Mulit-modal Mulit-view Clustering based on Non-negative Matrix Factorization. 2022 IEEE Symposium Series on Computational Intelligence (SSCI) , 4-7 December, 2022*

13. *M. Ben-Fares, N. Grozavu, P. Rastin, P. Holat. High Dimensional Data Stream Clustering using Topological Representation Learning. 2022 IEEE Symposium Series on Computational Intelligence (SSCI) , 4-7 December, 2022*

14. *N. Fanourakis, V. Efthymiou, V. Christophides, D. Kotzinos, E. Pitoura, K. Stefanidis. "Structural Bias in Knowledge Graphs for the Entity Alignment Task". 20th European Semantic Web Conference (ESWC), Hersonissos, Greece 2023*

15. *X. Nguyen, A Gyrovector Space Approach for Symmetric Positive Semi-definite Matrix Learning, in: ECCV, 2022, pp. 52–68*

16. *M. Chevallier, N. Grozavu, F. Boufarès, N. Rogovschi, C. Clairmont. Trade Between Population Size and Mutation Rate for GAAM (Genetic Algorithm with Aggressive Mutation) for Feature Selection. Artificial Intelligence Applications and Innovations (AIAI) (1) 432-444. Hersonissos, Crete, Greece, June 17-20, 2022*

Book chapters

1. *C. Lavandier, R. Aalmoes, R. Dedieu, F. Marki, S. Groarth, D. Schreckenberg, A. Gharbi, D. Kotzinos. Towards Innovative Ways to Assess Annoyance. Aviation Noise Impact Management: Technologies, Regulations, and Societal Well-being in Europe, Editors: Laurent Leylekian, Alexandra Covrig, Alena Maximova, Publisher: Springer Nature Switzerland AG, Mars 2022.*

2. *E. Noga-Hartman, D. Kotzinos. Assessing Together the Trends in Newspaper's Topics and User Opinions: A Co-Evolutionary Approach. Handbook of Research on Opinion Mining and Text Analytics in Literary Works and Social Media, Editors Pantea Keikhosrokiani and Moussa Pourya Asl, Publisher: IGI Global.*

HDR Defended

- *Maria Malek. Réseaux complexes : exploration, fouille et analyse multicouche CY Cergy Paris Université, 2022*

PhD Thesis Defended

- *Tarek Ben Charrada: Reconstruction d'objets 3D à partir d'une image monoculaire en utilisant l'apprentissage profonde. Defended the 07-10-2022 under the supervision of Hedi Tabia*

National Conferences

1. *A. Ntroumpogiannis, M. Giannoulis, N. Myrtakis, V. Christophides, E. Simon and I. Tsamardinos. A Meta-level Analysis of Online Anomaly Detectors 18me edition des journees Business Intelligence & Big Data (BDA) 2022*

2. *O. Houfi and D. Kotzinos, Use of Language Models for FactChecking and Claim Assessment (FRCCS), Paris, France, 20-22 June 2022.*

3. *V. Lee, J. Longhi, D. Picard, C. Simon Chane, M. Jordan et al. Les outils de l'apprentissage profond au service de l'évaluation et de la conservation des archives. Conservation-restauration des biens culturels, Association des Restaurateurs d'Art et d'Archeologie de Formation Universitaire (ARAAFU) 2022, 38, pp.7-16. <hal-03620940>*

4. *R. Tariba, J. Tardif, T. Trâm Dang Ngoc, S. Couchot-Schiex, V. Grand-Chavin et al. Dispositif de co-développement pour favoriser l'appropriation de l'APC dans une formation de Bachelor Universitaire de Technologie (BUT) Congrès de l'Association Internationale de Pédagogie Universitaire (AIPU), May 2022, Rennes, France*

5. *T. Trâm Dang Ngoc, V. Grand-Chavin, S. Couchot-Schiex, R. Tariba , J. Tardif et al. Une étude de cas de la dynamique d'une auto-organisation efficace d'une équipe pour résoudre un problème complexe dans un environnement complexe Congrès de l'Association Internationale de Pédagogie Universitaire (AIPU), May 2022, Rennes, France*

6. *E. Collignon, T. Trâm Dang Ngoc, F. Daumarie, L. Genty, V. Grange et al. Quelles compétences développer pour les praticiens d'Intelligence Collective? Congrès de l'Association Internationale de Pédagogie Universitaire (AIPU), May 2022, Rennes, France*

7. *T. Trâm Dang Ngoc, J. Leroy-Dudal, P. Leturmy, R. Pech-Janody, C. R. Picot et al. L'Intelligence Collective comme Levier d'Engagement et de Mise en Action dans la Conception et Déploiement d'une Unité d'Enseignement Transversale et Interdisciplinaire à Grande Échelle : l'UE CATI Questions Pour l'Enseignement Supérieur (QPES), Jan 2022, La Rochelle, France*

Publications of new team members (outside ETIS)

Conference papers

- *L. Brun, B. Gaüzère, G. Renton, S. Bougleux and F. Yger, "A differentiable approximation for the Linear Sum Assignment Problem with Edition". 26th International Conference on Pattern Recognition (ICPR), Montreal, QC, Canada, 2022, pp. 3822-3828*

NEURO

NEUROCYBERNETIC

General presentation

The Neurocybernetics team is part of an enactive approach to cognitive sciences. We seek to model a number of cognitive processes ranging from isolated neurons to social interactions. We are interested in understanding what properties can emerge from the different dynamics involved: dynamics of local circuits, dynamics between brain structures, dynamics with the physical but also social environment.

In this framework, robots become a simulation tool for the emerging properties of neural networks. Robotic experiments thus make it possible to show the coherence of the developed models (challenges of integration both at the modelling level and at the technological mastery level with applications for engineering sciences) but especially the limitations of the models used (proof by failure allowing in certain cases to demonstrate the importance of changing paradigm or to show the importance of previously neglected structures).

The NEUROCYBERNETICS team designs bio-inspired Artificial Intelligence (AI) models to understand human intelligence and creates AI and cognitive architectures to make robotic learning more efficient, autonomous and adaptive in social, affective and physical interactions. Themes are cognitive architectures, robotic learning, brain, perception and action modelling, sensorimotor control.

Applications are on autonomous, learning and interactive robots, autonomous vehicles, modelling the brain as a complex system, smart homes, sensors and bio-inspired robots.
We emphasize the importance of the body and action, the enactive approach, to model human intelligence and interact with people.
4 emblematic projects of our team (but not only) are:

- the art-loving Berenson robot
- Neuromimetic architectures for autonomous vehicle navigation
- Neurorobotic modelling for motion generation and motor control learning
- The Sensory Platform of the International Research House

In 2022, the team is organized into two research areas:

1. the brain-inspired neural networks architectures for efficient coding, control, perception, and decision making and,
2. robots, autonomous vehicles and smart devices for autonomous learning, and multimodal human-machine interactions, perceptually, socially, and emotionally.

Each of these makes it possible to create a core of expertise around a common theme and to organize the interaction at the scientific strategy level of each of them within the team and with the other ETIS teams.

Highlights

This year, the Neuro team is welcoming two new members, Marwen Belkaid, Junior professor chair, and Thanos Manos, Maître de Conférences, HDR. Ghilès Mostafaoui is awardee of the national project ANR ENHANCER. The international conference SAB2022 organized at Cergy by Lola Canamero and Philippe Gaussier, Sofiane Boucena, Nicolas Cuperlier was successfully held with 100 participants.

Synthesis of the research activity in 2022

This year 2022 is a good year in terms of publications with ten publications in high-standard journal papers (PNAS, PLoS One, Frontiers, Sensors) and eleven conferences papers (ICDL, Neurips, BioRob), and two book editions. The participation to national events and workshops shows the vitality of our team.

KPI

Members

At the date of 31th december 2022, the NEURO Group has:

- 13.5 permanent members:
    - 4 Full Professors
    - 1 CPJ – Chaire de Professeur Junior labélisée CNRS
    - 8 MCF including 3 HDR
    - 1.5 CNRS Engineers.
- 11 non-permanent members:
    - 9 PhD students including 1 ATER
    - 2 postdoc

Ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
BERGOIN	*QUOY TORCINI*	*UPF (Barcelone) LPTM*	*EUTOPIA*	*01/11/2020*	*STDP learning in large spiking neural networks*
COURSON	*QUOY MANOS*	*LPTM Warwick*	*MME-DII*	*01/10/2021*	*Neural network structure, onset and propagation of epileptic seizures (NetOPES)*
ELEY	*LAVANDIER KATZ*	*-*	*ED – LABEX Patrima*	*24/09/2019*	*Virtual Experience in Archaeological Acoustics: Multimodal study of the influence of halls on the playing techniques of musicians on wind instruments in the 17th and 18th centuries in Versailles*

JU	GAUSSIER	-	INEX	01/10/2018	How our brain code and manage spatial information: Modeling the interactions between the parietal cortex, the retrosplenial cortex and the hippocampal system
REYNAUD	QUOY	-	Professional Thesis (Part time)	23/11/2016	Insertion of robots in the world of work
LEMHAOURI	CANAMERO COHEN	VUB	EUTOPIA	01/10/2021	Computational modeling of language learning in robots: the development of meaning potentials in social and emotional contexts
MARCHAL	MOSTAFAOUI	VUB	EUTOPIA	01/10/2021	Embodied intelligence in robotic arms: leveraging human-inspired morphology for intra- and interpersonal coordination
L'HARIDON	CANAMERO	-	INEX	15/11/2021	La douleur et le plaisir dans la boucle motivation-émotion-cognition : les robots en tant qu'outils et que modèles
FAUVIAUX	MOSTAFAOUI	Euromov	ANR ENHANCRE	01/11/2022	Utilisation d'un Agent Conversationnel Animé pour améliorer la communication non verbale chez les patients atteints de schizophrénie

Interteam ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
ABDELWAHED	PITTI ROMAIN	VEDECOM	CIFRE	18/10/2018	Adaptive Impedance Spectroscopy for Characteristic Extraction and Exploitation of Artificial Skin: Application to Mobile Robotics as autonomous vehicule
COLOMER	CUPERLIER BRESSON ROMAIN	VEDECOM	CIFRE	05/11/2019	Integrated neuro-robotic approaches for autonomous vehicle localisation and navigation.

Ongoing Postdoc

Name	Supervisor	Partner	Type	Start	Date of defended	Length	Title
MICK	BOUCENNA		DIM RFSI	01/09/2021	31/08/2022	1 year	Emotional interactions : a way of communication for the development of an autonomous robot

Name	Supervisor	Partner	Type	Start		Length	Title
AUBIN	MOSTAFAOUI	APHP Pitié Salpétrière, ISIR	Co-financement APHP et AXLR ETIS	01/09/2021	31/12/2022	16 months	*Emotional interactions : a way of communication for the development of an autonomous robot*

PhD Defended

Name	Supervisor	Partner	Type	Start	Date of defended	Length	Title
COLOMER	*CUPERLIER BRESSON ROMAIN*	*VEDECOM*	*CIFRE*	*05/11/2019*	*16/12/2021*	*36 months*	*Integrated neuro-robotic approaches for autonomous vehicle localisation and navigation.*

Publications

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
10	11	2	7	2	2	1	1	3

Publications with others teams of ETIS

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
4	1	1	0	0	0	1	1	0

Contracts

New contracts

Name	Manager	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
DIM RFSI USPN	*CNRS*	*Région*	*DIM*	*PITTI*	*24/01/2022*	*25 month*	*24500€*	*24 500€*
ENHANCER	*CYU*	*ANR*	*ANR*	*MOSTAFA OUI*	*01/11/2022*	*4 years*	*722 373€*	*142 200€*
ERGANEO	*CYU*	*SATT*	*Maturation*	*GAUSSIER*	*31/10/2022*	*2 years*	*86 970€*	*81 000€*
DA PROJET	*CYU*	*LabEx*	*ANR*	*MANOS*	*22/01/2022*	*2 years*	*2 000 €*	*2 000€*

Ongoing contracts

Name	Manager	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
ENHANCER	CYU	ANR	ANR	MOSTAFAOUI	01/10/2022	4 years	722 373€	142 200€
ERGANEO	CYU	SATT	Maturation	GAUSSIER	31/10/2022	2 years	86 970€	81 000€
DA PROJET	CYU	LabEx	ANR	MANOS	22/01/2022	2 years	2 000 €	2 000 €
INEX 2021 COMOCA	CYU	EMERGENCE	INEX	MOSTAFAOUI	01/09/2021	2 years	25 000 €	25 000 €
DIM RFSI Matériel 2020	CNRS	Région IDF	DIM	BLANCHARD	30/01/2021	1 year 9 months	33 000€	33 000€
SFRI CO TUTELLE UTOPIA CY PhD Larue	CYU	EUTOPIA	Thesis	CANAMERO QUOY	01/10/2021	4 years	500 299 €	163 210 €
HAPP INEX 2021	CYU	INEX		QUOY	01/02/2021	36 months	345 000€	345 000€
NetOPES	CYU	Labex MME-DII + ED	Thesis	MANOS QUOY	01/10/2021	3 years	114 000€	114 000€
DIM RFSI	CNRS	Région	DIM	BOUCENNA	15/09/2020	2 years	58 000€	58 000€
MME DI	CYU	CY Fondation	Labex	MANOS	19/10/2020	3 years	18 310 €	4 000 €
PhD U. Pompeu Fabra Barcelone	CYU	EUTOPIA	Thesis	Quoy	01/11/2020	3 years	119 000 €	59 500 €
PhD	CYU	Labex MME-DII	Thesis	Quoy	01/10/2020	3 years	114 000 €	0 €
Chaire INEX NEUROBOT	CYU	INEX		QUOY CANAMERO	01/09/2020	5 years	866 097€	277 000€
INEX COGNITIVES	PIA	INEX	Workshop	GAUSSIER	16/06/2019	4 years	55 000 €	55 000 €

SCIENCES COGNITIVES	CYU	INEX	workshop	GAUSSIER	16/06/2019	4 years	87 811 €	55 000€
CIGALE	CYU	ONERA	DGAC Contract	LAVANDIER			796 763 €	15 000 €
Chaire de Professeur Junior	CYU	ANR	CPJ	BELKAID	01/09/2022	5 years	200 000€	200 000€

Scientific Dissemination

Invited conference

1. Manos T. Online Conference on Nonlinear Science and Complexity, Thessaloniki, Greece, 26-29 September, 2022 (invited oral presentation).
2. Sep 2022 Soft Robotics at SAB22, Cergy
3. Sep 2022 Body Image and Cross Sensory integration, IEEE EPIROB, Queen Mary University, UK
4. Nov 2022 Invited Talk, Workshop on Reservoir Computing, Labri laboratory, Inria, Bordeaux
5. Nov 2022 Invited Talk, Robotics research in Nouvelle-Aquitaine, Bordeaux (online)
6. Jun 2022 Invited Talk, SINFRA Workshop, Singapour
7. Oct 2022 Invited Talk, Ecole d'été. du GT8 du GDR Robotic, Moliets (online)
8. Juin 2022: invited Talk. Hopital de la Pitié Salpêtrière (AP-HP).
9. Sept 2022 Invited Talk, LIB Laboratory, Sorbonne University, Paris
10. Sept 2022 Invited Talk, Queen Mary University, London
11. Nov 2022 Invited Talk, Neural Connectivity and Plasticity Team (NCP), INSERM, Sorbonne University, Paris
12. Nov 2022 Invited Talk, Robotics research in Nouvelle-Aquitaine, Bordeaux (online)
13. May 2022 Invited speaker for a tutorial at the First School of AFIA (French Association for AI),

 https://www.sfgbm.fr/archives/11340

Event Organization

1. Alex Pitti Workshop on Body Image and Cross Sensory integration, Queen Mary University, London, UK, 2022, Sep. IEEE international conference ICDL Epirob. . https://sites.google.com/view/workshop-body-image/
2. Alex Pitti invited Samuel Bianchini (ENSAD), and Robert French (LEAT), séminaire fil rouge thématique at ETIS.
3. Team ETIS, Fête de la science, CY Cergy Paris University, 14 October 2022. Invitation of 5 persons.
4. Manos T. and Courson J. Fête de la science (presentation: Mathematics, neuroscience and hallucinations), CY Cergy Paris University, 14 October 2022.
5. Catherine Lavandier presented the field of acoustics at la Cité de la Sciences, 10 - 11 september in the frame of la Cité des Sens : l'Ouïe. Podcast can be found here
6. https://www.cite-sciences.fr/fr/au-programme/evenements/cite-des-sens-louie/quartier-recherche-et-innovation

7. *FROM ANIMALS TO ANIMATS 16: The 16th International Conference on the Simulation of Adaptive Behavior (SAB2022). General Chairs P. Gaussier & Lola Canamero, Publication chairs S. Boucenna & N. Cuperlier https://sab2022.sciencesconf.org/*

8. *Team ETIS, Visites insolites du CNRS , Octobre 2022*

9. *Ghilès Mostafaoui Created and Organized the first School on Learning and Neuroscience for Robotics (GDR Robotique, GT8) in October 2022, Moliets et Maa, France. https://sites.google.com/view/ecoledugt8/programme*

10. *A. Blanchard. Journée thématique du réseau métier des roboticiens et mécatroniciens (2RM CNRS) « Les roboticiens à l'heure des défis écologiques », décembre 2022, CY Cergy-Paris Université. Programme et videos : https://2rm.cnrs.fr*

Perspectives for 2023

Starting of two international thesis, CNRS IPAL Singapore with Nancy Chen (A-STAR institute) and C. Laschi (National University of Singapore). (L. Canamero, L. Cohen, Quoy, A. Pitti).

Participation to the national project PEPR Robotique Organique, (L. Canamero Axe4, A. Pitti Axe1) and to the PEPR ICARRE (digital Art and creativity).

Collaboration with Szilvia Kalacska, Chargé de Recherche CNRS INSIS, Laboratoire Georges Friedel (UMR5307), St. Étienne, for the CASCADE project (Classification of acoustic signals created during the deformation of microsamples).

Starting of the ANR project ENHANCER, 2PhD students, (G Mostafaoui).

Special Issue in Frontiers in Psychology, « Neurocognitive Features of Human-Robot and Human-Machine Interaction », Francesco Bossi, Ghilès Mostafaoui, Francesca Ciardo, https://www.frontiersin.org/research-topics/51997/neurocognitive-features-of-human-robot-and-human-machine-interaction

Event, exhibition Bio-inspiration, Cité des Sciences de La Villette, 22-23 april 2023. (supervisor A. Blanchard)

Travel grant for research collaboration to University of Tokyo, Ambassade de France au Japon. (A Pitti)

Publications

Books

1. *Manos T., Antonopoulos C.G., Batista A.M. and Iarosz K.C. (2022) Advancing our understanding of the impact of dynamics at different spatiotemporal scales and structure on brain synchronous activity Front. Netw. Physiol., 2, 1038239.*

2. *Proceedings of FROM ANIMALS TO ANIMATS 16: The 16th International   Conference on the Simulation of Adaptive Behavior (SAB2022). Editorial , P. Gaussier & Lola Canamero, S. Boucenna & N. Cuperlier*

Journals

1. *Annabi, L. Pitti, A. Quoy, M. (2022) Continual Sequence Modeling With Predictive   Coding Front. Neurorobot. 16:845955*

2. *Abdelwahed, M. Zerioul, L. Pitti, A. and Romain O. (2022) Using Novel Multi-Frequency Analysis Methods to Retrieve Material and Temperature Information in Tactile Sensing Areas. Sensors, 22(22), 8876*

3. *Pitti, A. Weidmann, C. Quoy, M. (2022) Digital computing through randomness and order in neural networks, PNAS, 119 (33) e21153351*

4. *Pitti, A. Quoy, M. Lavandier, C. Boucenna, S. and Weidmann, C. (2022) In Search of a Neural Model for Serial Order: A Brain Theory for Memory Development and Higher Level Cognition, IEEE Transactions on Cognitive and Developmental Systems, 14, 2, 279-291.*

5. *Colomer ,S. Cuperlier, N. Bresson, G. Gaussier, P. Romain, O. LPMP: A Bio-Inspired Model for Visual Localization in Challenging Environments Frontiers in Robotics and AI, 2022, 8, (10.3389/frobt.2021.703811)*

6. *Lavandier C., Regragui M., Dedieu R., Royer C., Can A., "Influence of road traffic noise peaks on reading task performance and disturbance in a laboratory context", Acta Acustica, 6, n°3, (2022). doi.org/10.1051/aacus/2021057 Erratum: doi.org/10.1051/aacus/2022003*

7. *Aumond P., Can A., Lagrange M., Gontier F., Lavandier C., "Multidimensional analyses of the noise impacts of COVID-19 lockdown", The Journal of the Acoustical Society of America, Vol. 151, pp. 911-923, (2022). doi.org/10.1121/10.0009324*

8. *Lemaitre G., Aubin F., Lambourg C., Lavandier C., "Acceptabilité du confort acoustique à bord des trains", Revue générale des chemins de fer, n°328, pp. 6-16, juillet-août 2022. https://www.sncf.com/fr/innovation-developpement/innovation-recherche/ameliorer-confort-acoustique-trains*

9. *Parenti, L., Lukomski, A. W., De Tommaso, D., Belkaid, M., & Wykowska, A. (2022). Humanlikeness of feedback gestures affects decision processes and subjective trust. International Journal of Social Robotics, 1-9.*

10. *Mostafaoui G, Schmidt RC, Hasnain SK, Salesse R, Marin L (2022) Human unintentional and intentional interpersonal coordination in interaction with a humanoid robot. PLOS ONE 17(1): e0261174. https://doi.org/10.1371/journal.pone.0261174*

Conferences

1. *Li, X He, J and Pitti, A (2022) Travelling Wave Locomotion of a Tensegrity Robotic Snake based on Self-Excitation Controller, BioRob2022*

2. *Chen, X Pitti, A (2022) Visuo-Motor Remapping for 3D, 6D Reach and Tool-Use Reach using Gain-Field Networks, IEEE ICDL Epirob, p320-327.*

3. *Annabi, L Pitti, A Quoy, M. (2022) On the Relationship Between Variational Inference and Auto-Associative Memory, NeurIPS.*

4. *Colomer ,S. Cuperlier, N. Bresson, G. Pechberti, S. Romain, O. Sparse and topological coding for visual localization of autonomous vehicles. FROM ANIMALS TO ANIMATS 16: The 16th International Conference on the Simulation of Adaptive Behavior (SAB2022), Sep 2022, Cergy Pontoise, France*

5. *Eley N., Psychoyou T., Lavandier C., Katz B.F.G., "A Custom Feature Set for Analyzing Historically Informed Baroque Performances", Proceedings of the 24th International Congress on Acoustics, October 2022, Gyeongju, Korea. 8 pages*

6. *Schaffer B., Bertsch L., Le Griffon I., Heusser A., Lavandier C., Pieren R., Evaluation of flyover auralizations of today's and future long-range aircraft concepts, InterNoise 2022, August 2022, Glasgow, Scotland. 8 pages*

7. *Lemaitre G., Aubin F., Lambourg C., Lavandier C., How does the train background noise affect passengers' activities? Determining thresholds of noise levels ensuring a good comfort for passenger, World Congress on Railway Research, Birmingham, 2022. 6 pages*

8. *Eley N., Lavandier C., Psychoyou T., Jossic M., Katz B.F.G., "Performance analysis of solo baroque music played in a period and modern hall", Actes du 16ème Congrès Français d'Acoustique, 6 pages, Marseille, avril 2022.*

9. Lambourg C., Lemaitre G., Aubin F., Lavandier C., "Détermination de seuils de bruit dans les trains à grande vitesse". Actes du 16ème Congrès Français d'Acoustique, Actes du 16ème Congrès Français d'Acoustique, 5 pages, Marseille, avril 2022.

10. Parenti, L., Marchesi, S., Belkaid, M., & Wykowska, A. (2023). Attributing intentionality to artificial agents: exposure versus interactive scenarios. In Social Robotics: 14th International Conference, ICSR 2022, Florence, Italy, December 13–16, 2022, Proceedings, Part I (pp. 347-356). Cham: Springer Nature Switzerland.

11. J.-M. Bah, G. Mostafaoui and L. Cohen, "A kinematic study on social intention during a human-robot interaction," **2022 IEEE International Conference on Development and Learning (ICDL)**, London, United Kingdom, 2022, pp. 202-207

Book Chapters

1. Lavandier C., Aalmoes R., Dedieu R., Marki F., Großarth S., Schreckenberg D., Gharbi A., Kotzinos D., "Towards Innovative Ways to Assess Annoyance" in Aviation Noise Impact Management: Technologies, Regulations, and Societal Well-being in Europe, Leylekian L., Covrig and Maximova A. Ed., Springer Press, pp. 241-264, 2022. eBook open access ISBN 9783030911942, (édité) ISBN 9783030911935. https://link.springer.com/book/10.1007/978-3-030-91194-2

2. Asensio C., Aumond P., Can A., Gascó L., Lercher P., Wunderli J.M., Lavandier C., De Arcas G., Ribeiro C., Muñoz P. and Licitra G.: "A taxonomy proposal for the assessment of the changes in soundscape resulting from the COVID-19 lockdown." in New Indicators for the Assessment and Prevention of Noise Nuisance, Fredianelli L., Lercher P. and Licitra G. (Eds.), pp. 21-29, Published in November 2022. This book is a reprint of the Special Issue New Indicators for the Assessment and Prevention of Noise Nuisance that was published in IJERPH. ISBN 978-3-0365-5739-7 (Hbk); ISBN 978-3-0365-5740-3

   https://doi.org/10.3390/books978-3-0365-5740-3

   https://www.mdpi.com/books/book/6352-new-indicators-for-the-assessment-and-prevention-of-noise-nuisance

International workshops

1. Couppey Thomas, Kolbl Florian, Quoy Mathias, Romain Olivier, Regnacq Louis, Giraud Roland (2022) Conduction block stimulation optimization by envelope modulation toward the reduction of onset response, FENS, July, Paris.

2. Bergoin Raphaël, Zamora-Lopez Gorka, Torcini Alessandro, Quoy Mathias (2022) Role of inhibition for the formation of neural assemblies in plastic neural networks subject to selective stimuli, FENS, July, Paris.

3. Lise Aubin, Marie Raffin, Ghilès Mostafaoui, David Cohen, Benoit Girard, 2022 Exploration of the respective roles of cortex and basal ganglia in catatonia with a computational model. FENS, 9-13 july, Paris.

National workshops

1. Bergoin Raphaël, Zamora-Lopez Gorka, Torcini Alessandro, Quoy Mathias (2022) Inhibitory neurons stabilise the formation of neural assemblies via adaptation and selective stimuli, Workshop: The interplay of complex and coherent dynamics in brain function, Cergy-Pontoise, May.

2. Courson J., Thanos M., Quoy M. and Timofeeva Y., The role of epileptogenicity strength and onset location in epileptic seizure propagation in mice brain: a computational study. Presented at Ecole d'automne GT8 Apprentissage et neurosciences pour la robotique (October), and 2022 Conference in Nonlinear Science and Complexity (September).

3. A. Blanchard, A. Pitti. « Rationalizing Humanoïd Platforms for Studies on Navigation, Interaction and Facial Expression. » JNRH 2022 - Journées Nationales de la Robotique Humanoïde. Angers

Patent

1. *"using spectral EIT in artificial skin for detection and thermal detection", M. Abdelwahed, O. Romain, L. Zerioul, A. Pitti, sept 2022.*

ETIS // Équipes Traitement de l'Information et Systèmes
RAPPORT ANNUEL 2022

Design -STS

General presentation of the Design Research Group

The Design Research Group was created in 2022 and is headed by Annie Gentes, director of research of CY School of Design. It analyzes contemporary design activities and challenges in particular when supporting sustainable transitions. The goal is to better understand transition design environments and dynamics: new design materials - from the living to AI -; multiplicity of scales - leading to questions of visualization, representation, translation, mediation and consultation; increasing complexity of systems and problems and working in the unknown - requiring intermediate design objects, prototypes and simulations.

The group also fosters a research axis devoted to emerging practices in Science and Technology Studies (STS), with an emphasis on practice-based research, Art & Science as a research tool for critical thinking, and a focus on research objects investigated by the other ETIS teams.

Highlights in 2022

- October 2021, arrival Annie Gentes, director of research, CY school of design

- Creation of the Design Research Group.

- *Accreditation of LINDDA: **L**iving **IN**frastructure to **D**esign responsible **D**igital technology for **A**groecological transition: flagship project of the PEPR Agro-Ecology from 2022 to 2027.*

- June 2022, arrival Lilyana Petrova, Associate Professor in art, design and information and communication sciences

- September 2022, arrival Giulia Marcocchia, Associate Professor in design management sciences.

Synthesis of the research activities in 2022

Much of 2022 has been focused on the Launch of LINDDA project, connecting with the different stakeholders in the field and starting to define the research methodologies with the actors: farmers, distributors, consumers, local governments, …Two principle fields of research have been defined: one in the Alps region to address the governance of water, the other in Montpellier to address low tech digital solutions for farms exploitations.

The 2 PHD candidates also started their field work: One research intends to define the role of design for territories in transition. By deconstructing the terms used, by studying what the players have to say, and by observing their practices, we propose to examine the methods and effect of this emerging design on local communities. The other research takes place in an association that co-designs and deploys tools for people with disabilities. This thesis addresses the challenges of inclusive transition, in relation with disability: it examines the divergent interests of the various actors of the ecosystem, and

the complexity of its implementation in the field. It analyses new participatory design methodologies and tools for the inclusive transition. and analyze the new roles of the designers.

CY School of design also launched its Master program on Sustainable Design. Master students started their research work with the goal of publishing in international conferences or scientific papers.

KPI of the Design-STS group in 2022

Members

As of 31st December 2022, the Design-STS Group has:

- 2 permanent members:
    - o 2 Associate (MCF) Professors (Lilyana V. Petrova, Sylvain Reynal)
- 5 non-permanent members:
    - o 1 Full Professor (Annie Gentes) and 2 Associate Professors (Giulia Marcocchia, Jean-Louis Soubret) from CY Ecole de Design
    - o 2 PhD Students registered at the ED of CYU (Stéphanie Hémon, Pauline Oger)

Publications

Journal	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
3	1	5	3	–	–	–	–	

Publications with others teams of ETIS

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
0	0	0	0	0	0	0	0	0

Ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
OGER	Annie Gentes / Marie-Julie Catoir	Signes de Sens	CIFRE	Septembre 2022	Co-designer la transition inclusive : comment le design peut-il créer, équiper et accompagner des communautés vers la transition inclusive ?
HENON	Annie Gentes /Dominique Bessières	-	CIFRE puis Erasmus +	Novembre 2021	Le design de territoire : un nouveau type d'intervention publique ?

Overview of contracts

New contract

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
LINDDA	ANR	PEPR	INRAE	08/01/2023	5 years	1 444 008,00 €	517 800,00 €

Scientific Dissemination

Event Organization

- *Gentes, Annie, Parallel Session: "Mediums in Design", SIG Design Theory Workshop, Mines-ParisTech, Paris, 31 January, 2022*

- *Gentes, Annie et Lévy Pierre, chaire de design Jean Prouvé, CNAM, Monthly Seminar CY-CNAM : « Médiums en design https://chaire-design.fr/seminar/mediums-en-design/*

- *Petrova, Lilyana & Ghislaine Chabert, «Designs-Designer-Déjouer : jeux et enjeux du design à l'université », Journée d'étude, Université Jean Moulin Lyon III, Lyon, 25 November, 2022*

- *Petrova, Lilyana, Ross, Louis. Journée Workshop "Protocoles pour un imaginaire perpétuel", Université Jean Moulin Lyon III, Université Xavier de Louisiane & Institut International pour la Francophonie, 11 Décembre, 2022. https://imaginaire. hypotheses.org/1197*

National and local scientific responsibilities

- *Lilyana Petrova, membre du Conseil Scientifique de l'exposition "Design-Designs-Designers", organisée dans le cadre de la fête de la science, du 4 octobre 2022 au 4 janvier 2023*

International scientific responsibilities

- *Annie Gentes, member of the editorial committee Sciences du design*

- *Giulia Marcocchia, co-head, SIG Design practices, Design Society*

Invited Talks

- *Marcocchia G, Sept 16th 2022, Speaker at EAIE conference, Barcelona, Spain "Co-creation on a European University scale: linking with society to create innovative approaches and learning formats"*

- *Petrova, Lilyana, Reynal Sylvain, "Intelligence interstitielle : entre IA et création, l'interstice comme modalité de la recherche", Séminaire IA, Art et Créativité, Centre Internet et Société du CNRS Paris-Pochet, 6 Décembre 2022.*

- *Petrova, Lilyana "Des hypermédias aux inframédias : un parcours de recherche-création". Séminaire IMPEC (Intéractions Multimodales Par Écran), EN ligne, Lyon, 21 janvier 2022*

Research perspectives for 2023

The Design Research Group wants to develop the business and management aspects of transition design and to develop a theoretical framework for transition design. The Group also wishes to strengthen the interdisciplinary dynamics between ETIS teams to enable collaboration on complex interdisciplinary topics involving technological studies and critical approaches, with appropriate innovative methodologies. We therefore want

To get a tenure track position in management of emerging ecosystems (chaire de professeur junior): Management approach to emerging eco-systems: analysis followed by research-intervention to help structure networks by deploying processes and tools that foster the convergence of diverse interests among heterogeneous stakeholders.

- To deploy Transition Design methodologies from the outset of projects: co-creation methodologies to propose solutions and configurations at the scale of value networks, an inclusive creation approach through the integration of users (Human Centered Design), a "living lab" dimension for experimentation (co-creation workshops, solution prototyping). The tools and methods of Transition Design support experimentation, particularly in the "infrastructuring" dimension.

- To initiate a Chair on sustainable food systems: to explore imminent or desirable developments in the food sector in all its diversity and globality, in support of public and private operational projects.

- To obtain ANR funding for ambitious interdisciplinary projects between Engineering Studies, Science and Technology Studies and Design with focus on technology for sustainability : "Study and simulation of sensible cycling experiences for the development of sustainable mobility infrastructure".

- To develop inter-team dynamics within ETIS, and conduct research on topics related to the interaction between technology and the body. This will need funding for a PhD project to support the research as well as multiple initiatives to enforce the collaboration and scientific exchange between ETIS members from different teams.

Publications 2022

Journals

1. Annie Gentes et Avner Perez, « Le « traduire » comme paradigme de la pratique du design », Appareil [En ligne], 24 | 2022, mis en ligne le 22 juillet 2022, consulté le 12 septembre 2022. URL : http://journals.openedition.org/appareil/4427 ; DOI : https://doi.org/10.4000/appareil.4427

2. Gentes, A, « Pour une théorie « média-centrée » du design », in ATIC vol1, N°4, Septembre 2022, pp. 51-71

3. Ibanez-Bueno, Jacques, and Lilyana V. Petrova. "From Video Game to Ethnographic Video Game". Revue Française Des Méthodes Visuelles, no. Hors Série, accepted to be published 2022

International conferences

1. Marcocchia, G (2022) "Innovation eco-systems as platforms for scalable farmer-centric change " in Véronique Bellon Maurel, Nicolas Tremblay, Simon Cook, Myrtille Lacoste, James Taylor, et al.. Proceedings of the 1st International Conference on Farmer-centric on- farm experimentation (OFE2021): Digital tools for a scalable transformative pathway. 1st International Conference farmer-centric on-farm experimentation (OFE2021), Oct 2021, Montpellier, France. 2022.

National conferences

1. Gentes, Annie, "Ecrire le Futur, Pratiques poétiques en ingénierie et en design », Séminaire Design with Care, Chaire CNAM, Paris, 9 février 2022

2. Gentes, Annie, « la recherche en design en entreprise », Table ronde, Séminaire Inspire, Biennale de design de Saint Etienne, Saint Etienne, 17 mai 2022.

3. *Reynal, Sylvain. Pour qu'on ne se débarrasse pas des hommes: Entre art et sciences, l'ingénieur face à l'ambivalence du sujet. Actes de la conférence Drôles d'objets, La Rochelle, 2022.*

4. *Petrova, Lilyana V., "Beyond is the new sexy : comment dépasser l'interdisciplinarité par l'art ?", Séance méthodes numériques et interdisciplinarité, Journées du Centre Internet et Société, 5-6 Octobre 2022*

5. *Reynal Sylvain, Martel Clémence, "S.T.U.M.P.S., du hacking à la scène : conception d'un dispositif performatif art/science entre cyborg et voix chantée", «Designs-Designer-Déjouer : jeux et enjeux du design à l'université », Journée d'étude, Université Jean Moulin Lyon III, Lyon, 25 November, 2022*

Science and society

1. *Gentes, Annie, « Quel design pour quelle entreprise ? », les Conférences d'IX campus, Saint-Germain en Laye, 20 juin 2022*

2. *Reynal Sylvain, Lizé-Masclef Ninon, Wunderblock, interactive installation exhibited at the Art & Science festival Teatri del suono/Soglie, Trieste (Italy), October 14-22, 2022.*
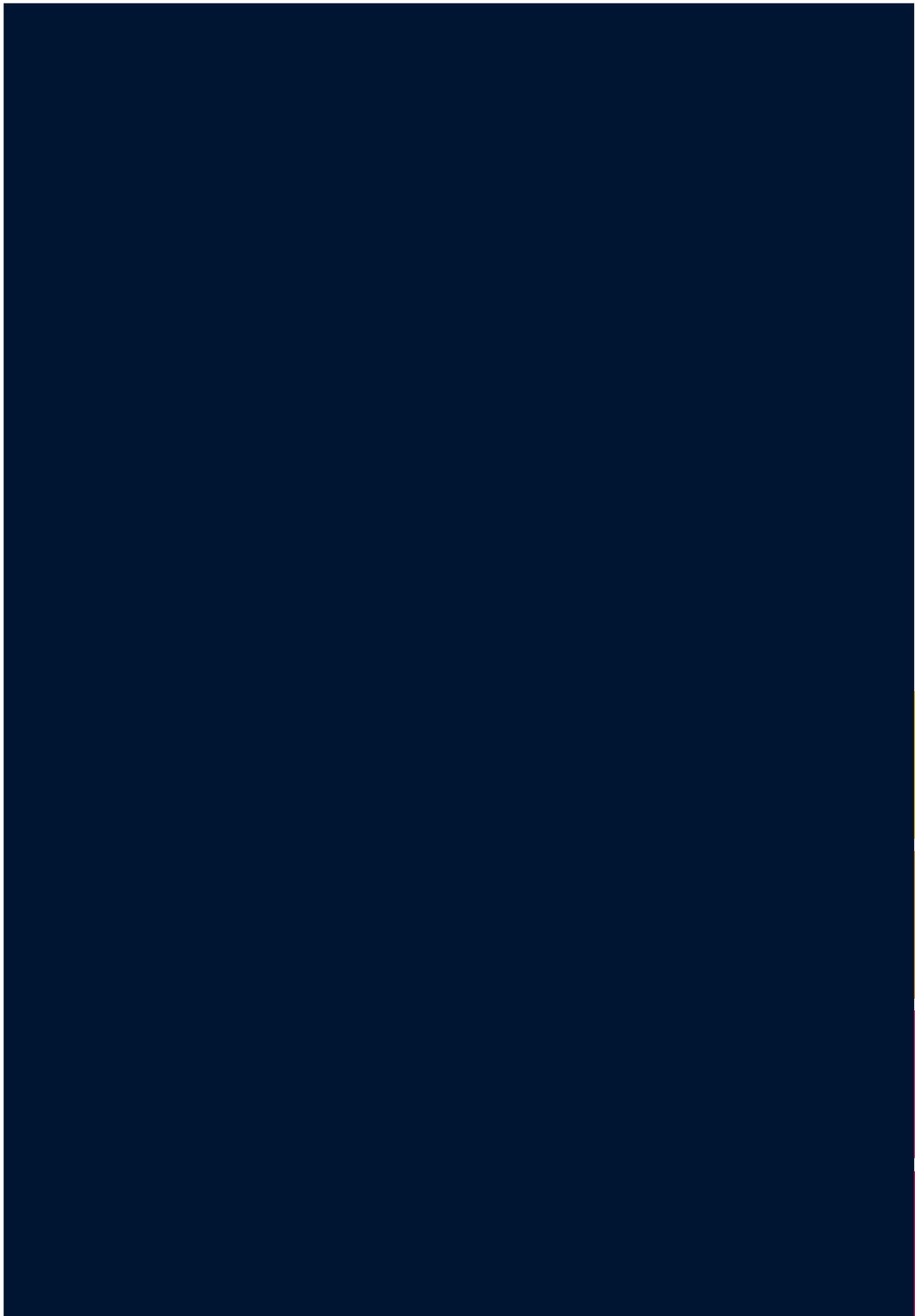
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