



Annual Report 2021



Équipes Traitement
de l'Information
et Systèmes





EDITORIAL
OF
OLIVIER
ROMAIN

2021 WAS A RICH YEAR IN EVENTS

The year 2021, like the year 2020, was also marked by the global health crisis of COVID-19, which had an impact on the laboratory, mainly in terms of international outreach (conferences, visiting professors and co-tutored theses).

Nevertheless, the laboratory has shown incredible resilience in its scientific activities as well as in the development of its project around intelligent and communicating systems, complementary issues around AI, security, health, IoT and new mobilities. To support the latter, the laboratory has included four 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 financial resources, (iii) the strengthening of human resources, and (iv) the international development of the laboratory. These actions have been amplified at the level of the management and the four research teams and the year 2021 has been punctuated by excellent results. Thus, our flagship fields have been supported by PIA research projects (in particular the Equipex+ Espadon, INEX and EUTOPIA teams), recognised by awards, nominations and high-impact publications, and promoted through events (Futurobot, etc.), industrial projects (CIFRE), international collaborative projects (ANR PRCI) and research actions with the IRL IPAL.

At the laboratory level, the actions undertaken within the framework of the missions created by the new management (equality-parity, international, support for young people, communication and scientific animation) have been expanded. The laboratory has a new graphic charter and a new website. A tri-lingual "equality-parity" charter has been implemented. Interdisciplinarity continues to be cultivated through two new TREMPLIN projects at the interfaces of the teams (Unconventional Imaging and Semantic 6G Wireless Communications, AAP UNIQUE INS2I), the monthly "fil rouge" seminar, CIFRE theses (Vedecom, IDEMIA, ...), ANRs, European projects, and, the incubation of a new research group in Design since September 2021. On the international front, the actions carried out have enabled an increase in EUTOPIA theses, a rapprochement with the IRL IPAL through future doctoral programmes (INEX CYU, A*STAR and NUS funding) and an international "Emerging Imaging" team with the Centro de Matematica Aplicada, Universidad Nacional de San Martin, Buenos Aires, Argentina. Finally, a Junior Professorship "Bio-Inspired Modelling of Cognitive Functions and Adaptive Behaviour" has been obtained for 2022 and labelled by the CNRS.

Concerning the teams, CELL continues to develop and stand out scientifically in the field of intelligent embedded systems applied to health, security and IoT through, 2 awards, 14 journals, 3 patents, 1 ANR PRCI, 2 DIM RFSI, 1 CIFRE, 2 SRV ENSEA, 4 ANR AAPG2021 projects submitted, 1 European Pathfinder project, a new platform (CNRS,

ENSEA, CYU) on multimodal analysis of movement and the organisation of the first CNRS thematic school on bio-electronic interfaces.

The ICI team continues its scientific excellence in information processing and wireless communications. Thus, the ICI team was involved in the construction of the PEPR 5G project, under the CNRS leadership. The outstanding results of this team were accompanied by 23 published papers, 1 new EUTOPIA thesis with Warwick, 1 DIM RFSI project and 1 DIM Math Innov project. 5 new ANR projects were submitted. Kevin Carrier (MCF tenure track) joins the team to support research projects in post-quantum security and networking.

The MIDI teams continues to refocus on two research axes: indexing and data analysis, with important and remarkable developments in the field of digital humanities (heritage data) funded through the Espadon team, the FSP, and the field of anomaly identification in time series (two theses in co-supervising with VUB and Ljubljana). Nistor Grozavu (Professor) and Michele Linardi (MCF) are joining the MIDI team to support the team's work on the analysis of structured and unstructured multimodal data, as well as on time series. The team has been particularly involved in the renewal of the DIM MAP (DRIM PAMIR). The excellent results of this team have been demonstrated through 8 journals including IEEE PAMI, 2 EUTOPIA, 2 CIFRE, 1 INEX, 1 DIM MAP. 8 research projects in response to the AAPG ANR2021 have been submitted

Finally, concerning the NEURO team, 2021 was the occasion to initiate the first research works within the framework of the INEX Neuroscience and Robotics chair while maintaining the excellence of the team, in the fields of bio-inspired AI modelling and cognitive architectures. The NEURO team has notably organised the Futurobot event (CNRS) in Cergy Pontoise in October 2021 and its actions have been accompanied by 7 published journals including 2 PloS (One and Computational Biology), 1 best paper at IROS, 1 DIM RFSI, 1 EUTOPIA thesis with Pompeu Fabra, and two INEX. Lola Cañamero is recognized among the 50 Women in Robotics you need to know about 2021.






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



ETIS 2021

KPI	6
 STRUCTURE OF THE LAB	7
 STAFF 2021	7
 6 STRATEGIC DOMAINS	8
 PUBLICATIONS	8
 PHD AND HDR	11
 EXPERIMENTAL EQUIPMENTS AND PLATFORMS	12
 BUDGET AND CONTRACTS	12
 ARRIVALS AND EXITS	13
 GDR AND DIM	15
ETIS IN 2021	16
GENERAL PRESENTATION	17
SCIENTIFIC ACTIVITIES	17
TEAMS AND GROUPS	18
HIGHLIGHTS 2021	20
SELECTED HIGHLIGHTS	21
VALORISATION	22
2021	22
OVERVIEW	23
PARTNERSHIPS	23
SPIN-OFFS	23
INTERNATIONAL	24

2021	24
INDICATORS 2021	25
OVERVIEW	25
MAIN ACTIVITIES IN 2021	25
EQUALITY AND PARITY	27
EQUALITY PARITY MISSIONS	28
MAIN ACTIVITIES IN 2021	28
COMMUNICATION AND VALORISATION	29
COMMUNICATION AND VALORISATION MISSIONS	30
MAIN ACTIVITIES IN 2021	30
STUDENT CLUB	31
OVERVIEW	32
MAIN ACTIVITIES IN 2021	32
CELL	34
GENERAL PRESENTATION	35
HIGHLIGHTS IN 2021	35
KPI OF CELL IN 2021	37
NEW CONTRACTS – FUNDING	40
ONGOING CONTRACTS	40
SCIENTIFIC DISSEMINATION	41
SCIENTIFIC MEDIATION (NATIONAL)	42
NEW PLATFORM	42
RESEARCH PERSPECTIVES FOR 2022	42
PUBLICATIONS 2021	42
ICI	46
GENERAL PRESENTATION	47
HIGHLIGHTS IN 2021	47

KPI OF ICI IN 2021	48
OVERVIEW OF CONTRACTS	50
SCIENTIFIC DISSEMINATION	52
RESEARCH PERSPECTIVES FOR 2022	53
PUBLICATIONS 2021	53
MIDI	58
GENERAL PRESENTATION	59
HIGHLIGHT	60
SYNTHESIS OF THE RESEARCH ACTIVITY IN 2021	61
KPI OF MIDI IN 2021	62
NEW CONTRACTS	65
ONGOING CONTRACTS	65
SCIENTIFIC DISSEMINATION	66
RESEARCH PERSPECTIVES FOR 2022	67
PUBLICATIONS 2021	67
PUBLICATIONS OF NEW TEAM MEMBERS (OUTSIDE ETIS)	70
NEURO	71
GENERAL PRESENTATION	72
HIGHLIGHTS	73
SYNTHESIS OF THE RESEARCH ACTIVITY IN 2021	73
KPI	73
CONTRACTS	75
SCIENTIFIC DISSEMINATION	77
PERSPECTIVES FOR 2022	78
PUBLICATIONS	78

KPI

Key
Point
Indicator

Structure of the Lab



Direction and administrative

- 1 director (CYU)
- 1 deputy director (ENSEA)
- 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 2021



159 people

63 permanents
13 ATER and Post-doc
66 PhD students
17 Associates and others

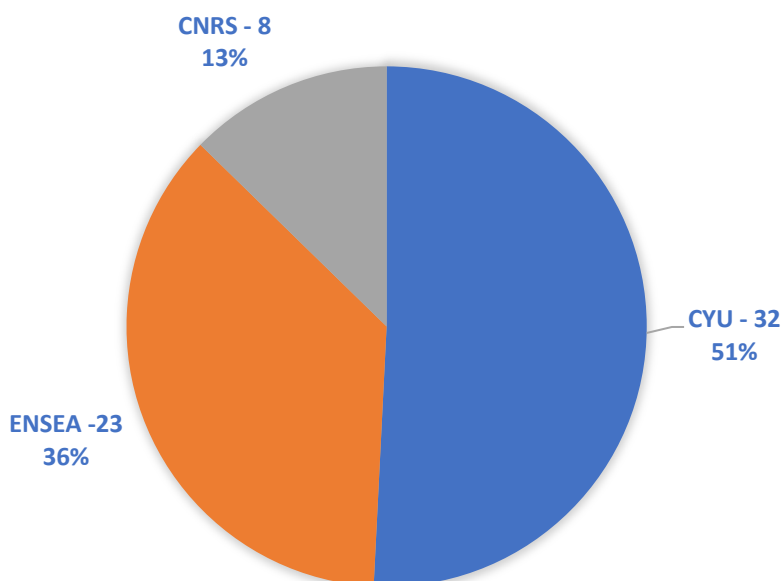


2 IUFS



63 Permanents

16 full Professors with 1 emeritus
33 assistant Professors
2 CR CNRS
13 ITA





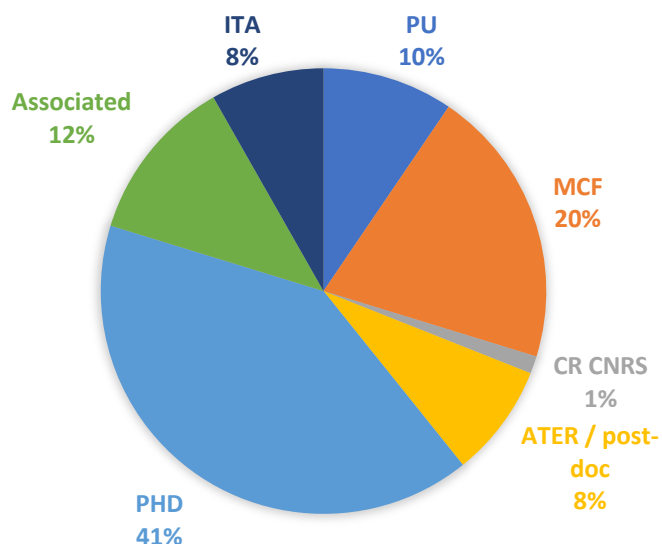
Average age 48 years



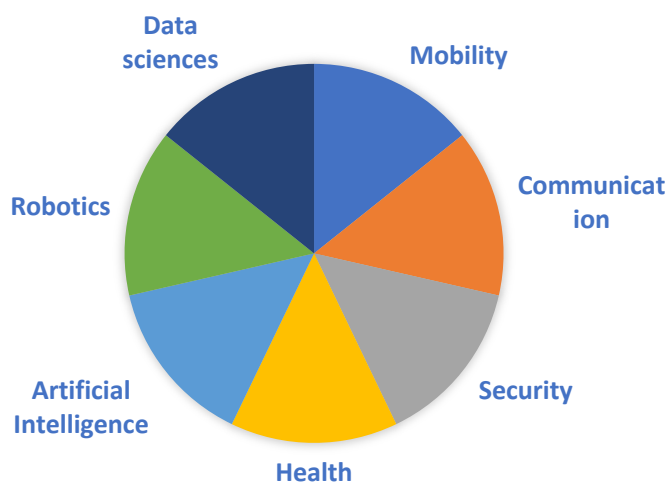
Gender parity

20 women – 31%

43 men – 69%



6 strategic domains



Publications

In 2021
Journals
52

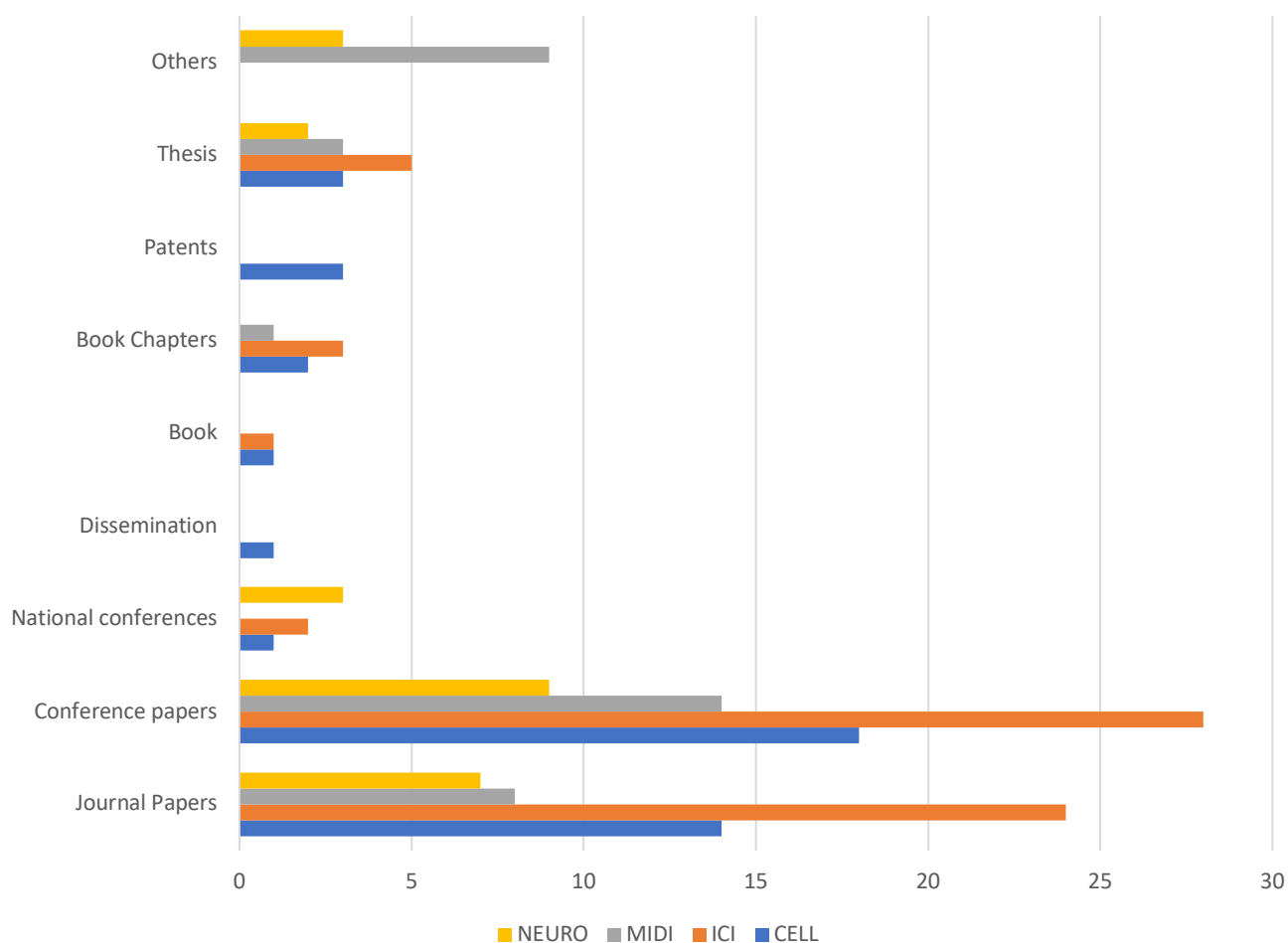
Conferences
63
Total
158

From 2019
Journals
145

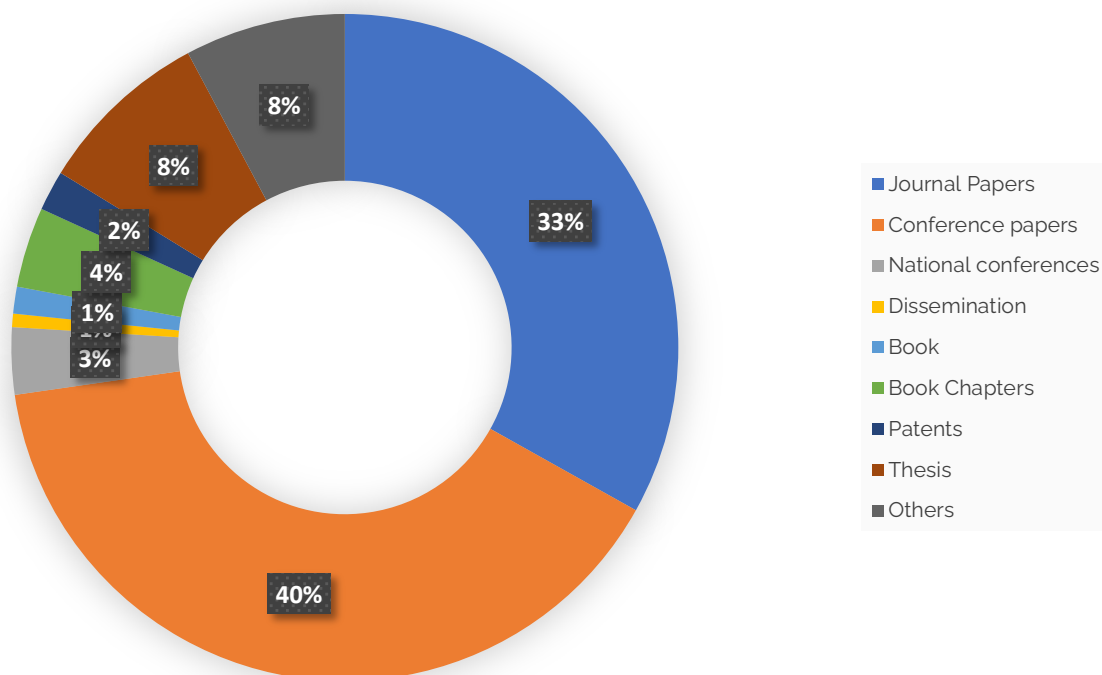
Conferences
180
Total
444

<i>Teams</i>	<i>Journals</i>	<i>Conferences</i>	<i>National conferences</i>	<i>Dissemination</i>	<i>Book</i>	<i>Chapters</i>	<i>Patents</i>	<i>Others</i>
CELL	14	18	1	1	1	2	3	0
ICI	24	28	2	0	1	3	0	0
MIDI	8	14	1	0	0	1	0	9
NEURO	7	9	3	0	0	0	0	3
Between Team	1	6	0	0	0	0	0	0
ETIS	52	63	7	1	2	6	3	12

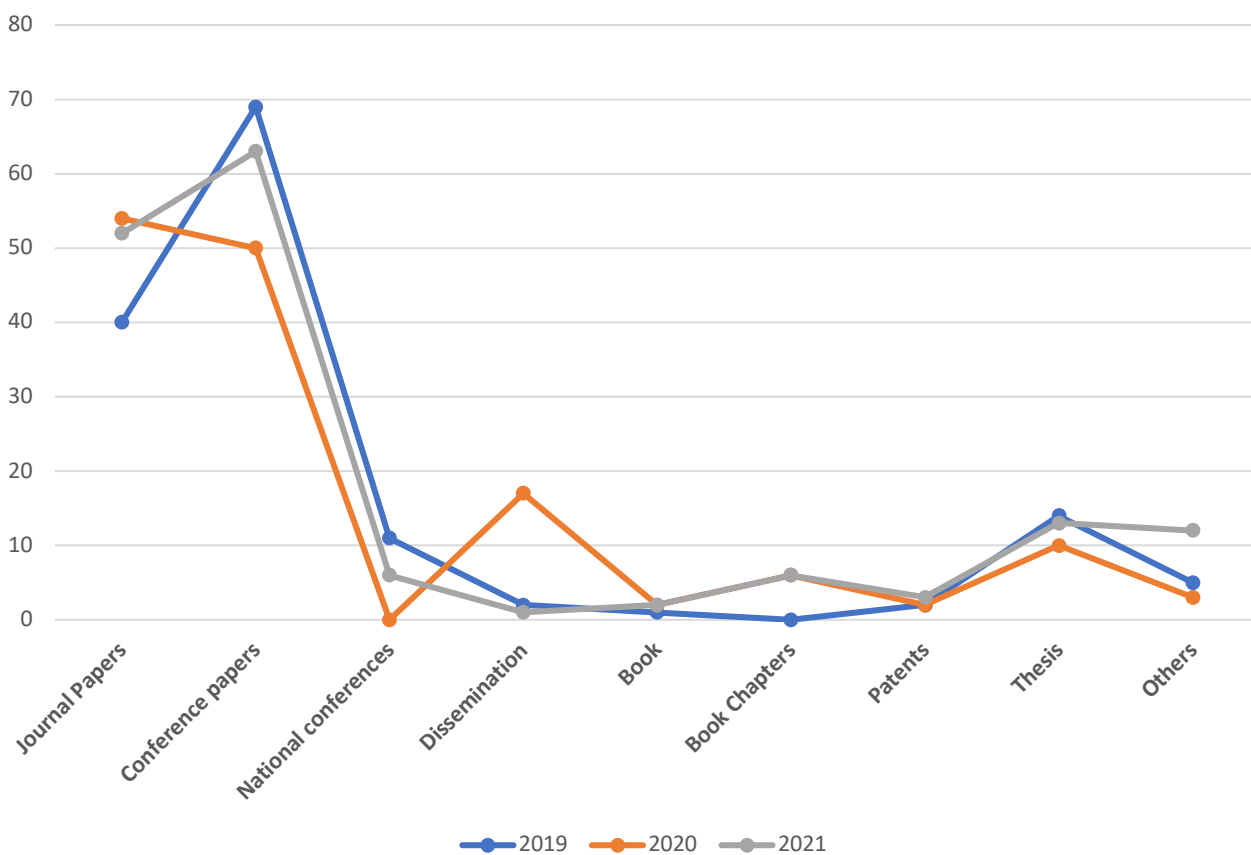
Publication per teams



Distribution of publication in 2021



Publications - ETIS - 2019 to 2021



2021
PhD defended

13

46.1 months

HDR

1

From 2019
PhD defended

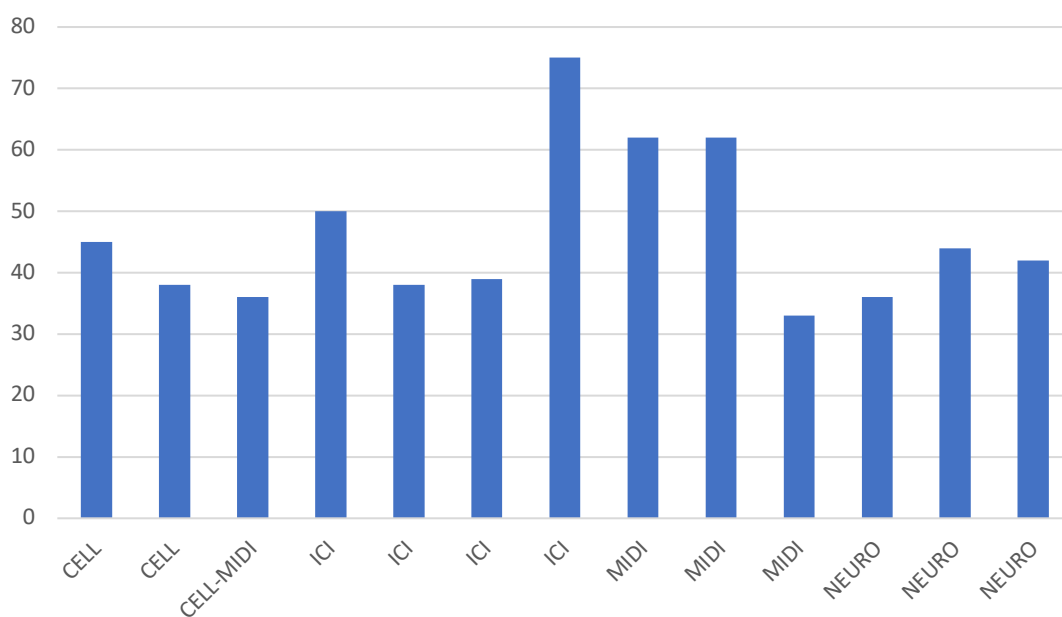
36

48 months

HDR

4

Teams	PhD defended	
CELL	2	Khelif – 12/07/2021 – 45 months Lahdhiri – 14/01/2021 – 38 months
ICI	4	Rezgui – 14/12/2021 – 50 months Tarpau – 07/12/2021 – 38 months Mokni – 16/12/2021 – 39 months Boushama – 02/12/2021 – 75 months
MIDI	3	Katsomallos – 13/12/2021 – 62 months Kontarinis – 13/12/2021 – 62 months Besbes – 30/06/2021 – 34 months
NEURO	3	Annabi – 15/12/2021 – 36 months Aubin – 09/12/2021 – 42 months Hoang – 12/04/2021 – 44 months
Interteam	1	Gizzini – 03/12/2021 – 36 months
ETIS	13 @ Doctoral School of CY	



Experimental equipments and platforms

> 79 scientific equipments	2 Equipex	<ul style="list-style-type: none"> - Robotex - Patrimex
	2 Equipex+	<ul style="list-style-type: none"> - Espadon - Tirrex
	7 platforms INS2I, CYU, ENSA	<ul style="list-style-type: none"> - Smart Gait - Smart Embedded Systems - Heritage - Image - Robotic and mobility - Processing - Acoustic

Budget and contracts

20 new contracts: 1.3M€

- 3 CIFRE
- 2 Equipex+
- 2 FSP
- 3 INEX
- 4 EUTOPIA
- 4 DIM RFSI
- 1 Labex MME-DII
- 1 ANR PRCI

45 ongoing contracts: 5.1M€

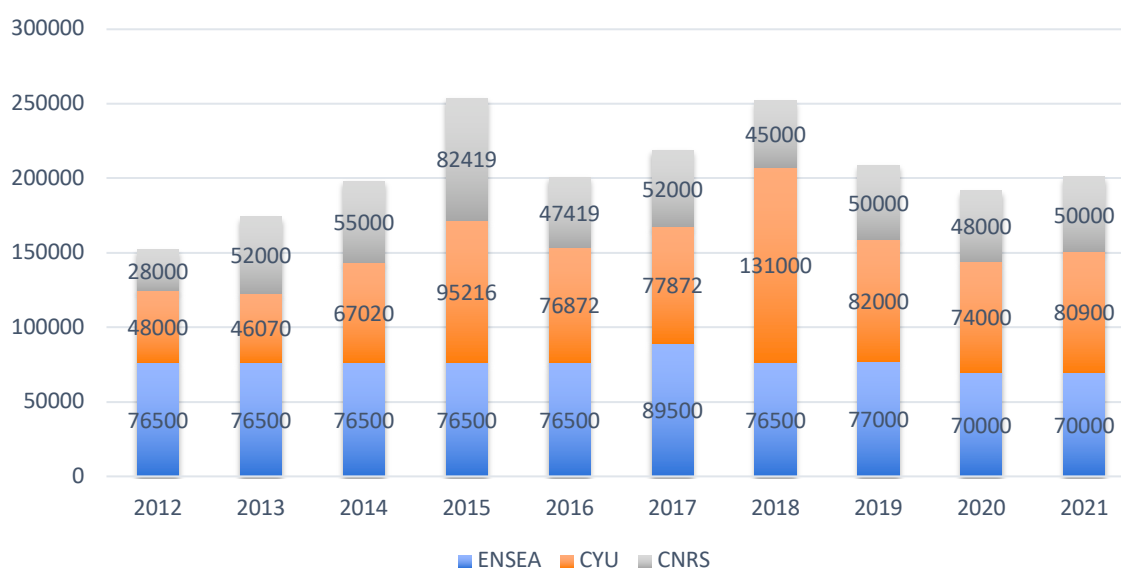
- 9 CIFRE
- 1 80 PRIME CNRS
- 14 INEX
- 1 FSP
- 3 DIM RFSI
- 5 ANR
- 1 Erasmus+
- 2 H2020
- 1 EUTOPIA
- 2 Labex MME-DII

- 3 PHC
- 1 ADEME
- 2 subcontracts

**Budget / sponsors CYU -ENSEA-
CNRS**

- 145.9 k€ for functioning
- 51k€ for equipment

Budget ETIS



Arrivals and exits

Permanents	Arrivals	Exits
ETIS		<ul style="list-style-type: none"> Cedric Dessennes, caesura
CELL	<ul style="list-style-type: none"> Mohamed Amine Khelif, PhD, MCF ESIEE-IT associated to the ETIS Lab Petr Dobias, PhD, Assistant Professor, ESIEE-IT associated to the ETIS Lab Sonia Yassa, PhD, Assistant Professor, CY-Tech, associated to the ETIS Lab Juan Angel Lorenzo De Castillo, CY-Tech, associated to ETIS Lab 	<ul style="list-style-type: none"> Pierre Lecoy, Professor Nga Nguyen, Assistant Professor
ICI	<ul style="list-style-type: none"> Kevin Carrier (tenure track), CY TECH 	

	<ul style="list-style-type: none"> Lylia Alouache, CY-Tech, associated to ETIS Lab 	
MIDI	<ul style="list-style-type: none"> Nistor Grozavu, Professor CYU, CY TECH Michele Linardi, Assistant Professor CYU, CY IUT 	<ul style="list-style-type: none"> David PICARD (now Professor LIGM)
NEURO		

PhD and others	Arrivals	Exits
CELL	<ul style="list-style-type: none"> Ozgun Yilmaz, ATER Pierre Jacob, ATER Laure Acin, PhD Alexandre Bordat, PhD Thomas Couppey, PhD Ihab Talleb, PhD 	<ul style="list-style-type: none"> Habiba Lahdhiri, PhD - CYU. Now Assistant Professor at ESIEE-Paris
ICI	<ul style="list-style-type: none"> Mahdi Shakiba Herfeh, Post-doc Sotiris Skaperas, Post-doc Muralikrishnan Srivivasan, Post-doc Cécile Bouette, PhD Amin Nassaj, PhD Ibrahim Sbeity, PhD 	<ul style="list-style-type: none"> Cécilia Tarpau, PhD defended Gada Rezgui, PhD defended
MIDI	<ul style="list-style-type: none"> Mussab Zneika, ATER Sayed Sadaf Ali, Post-doc Asma Garbi, Post-doc Alessandra Calvi, PhD Maha Ben-Fares, PhD Yasser Khalafaoui, PhD Nicolas Larue, PhD Maxime Marchal, PhD Nikolaos Myrtakis, PhD Xiatong Qian, PhD Alexandra Stoleru, PhD Tharsan Sentivel, PhD Laura Willot, PhD 	<ul style="list-style-type: none"> Wassim Swaileh, Post-doc Mohamed Besbes, PhD defended Emmanouil Katsomallos, PhD defended Alexandros Kontarinis, PhD defended
NEURO	<ul style="list-style-type: none"> Sébastien Mick, Post-doc DIM RFSI 	<ul style="list-style-type: none"> Louis Annabi, PhD defended Kevin Hoang, PhD defended

	<ul style="list-style-type: none"> Romain Dedieu, Post-doc Matthieu Goriot, PhD Zakaria Lemhaouri, PhD 	<ul style="list-style-type: none"> Julien Abrossimoff, cesure PhD
--	---	--

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 2021

General presentation

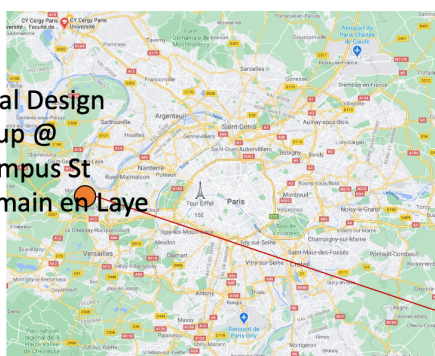


Équipes Traitement
de l'Information
et Systèmes

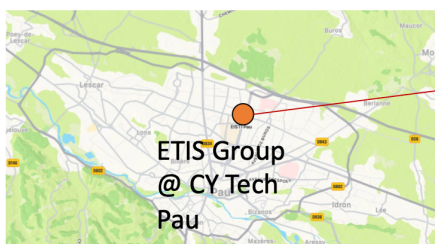
General presentation

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 jointly directed by Olivier Romain (DU) and Véronica Belmega (DUA). 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).

Social Design
Group @
Ixcampus St
Germain en Laye



ETIS Group
@ CY Tech
Pau



ICI and
CELL
teams
@ ENSEA



MIDI and
Neuro teams
@ CYU

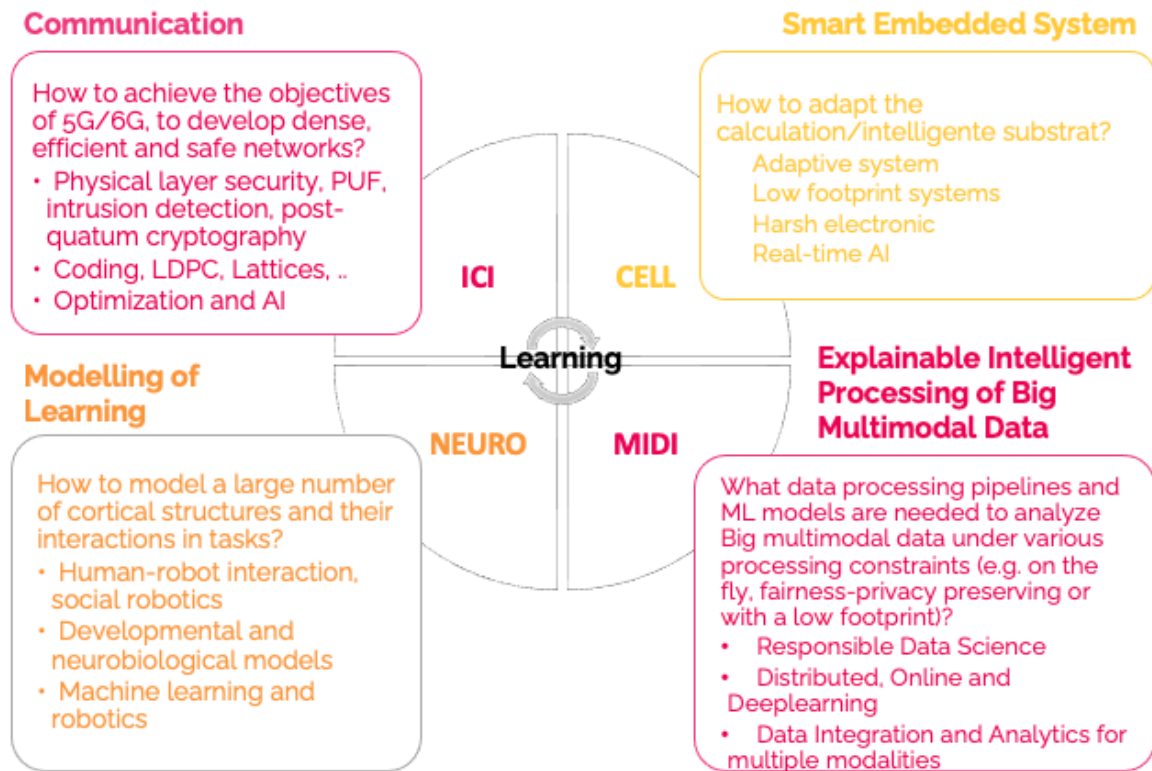
Sound
Platform
@ Neuville

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

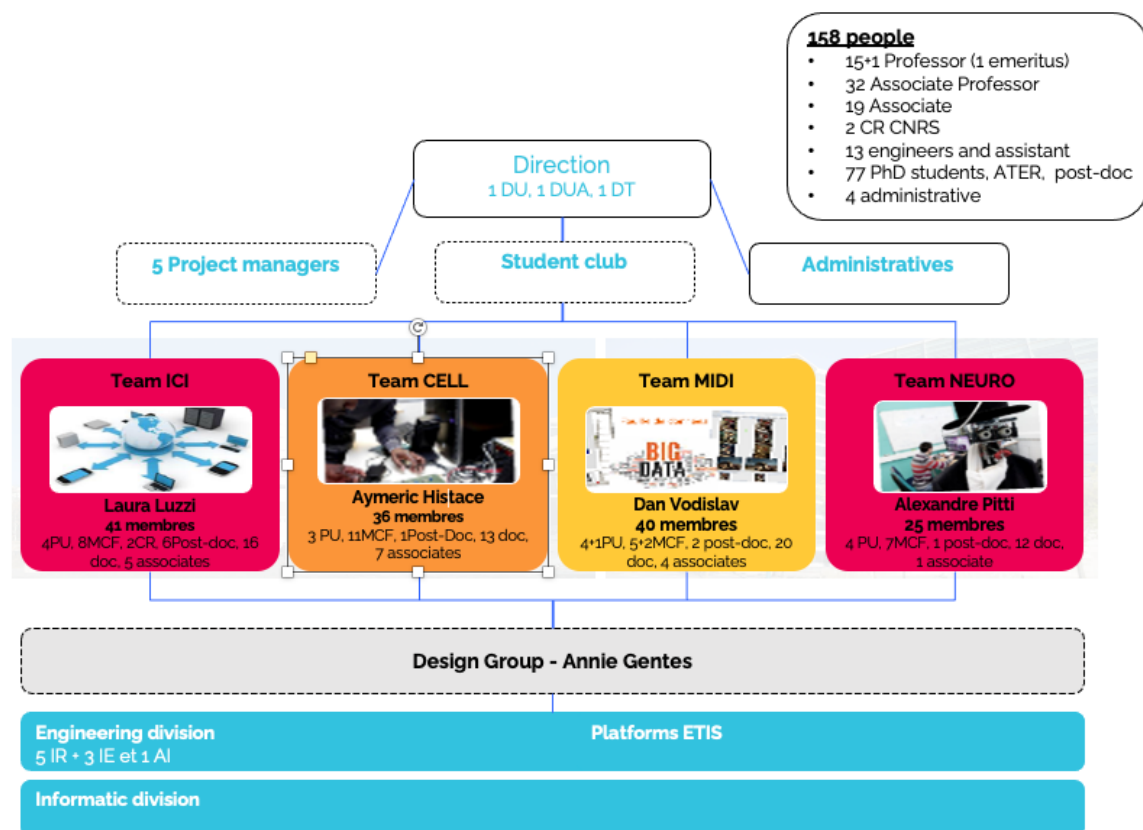
Europe 2020 (SNR) are also the backdrop for our research activities, in particular, those concerning "the information and communication society", "life, health and well-being", "Freedom and security of Europe, its citizens and residents", and "mobility and sustainable urban systems".

Concerning the socio-economic and cultural challenges, at the laboratory level, each team adopts a "bottom-up" approach favouring the emergence of fundamental issues while responding to solve concrete problems.



Teams and groups

As in 2020, ETIS is composed of 4 teams: CELL, ICI, MIDI and NEURO. Since September 2021, ETIS supported the development of the research group lead by Annie Gentes (Professor CYU) on Design (more information are available on the web site of the Lab).



Highlights 2021

Projects
Awards
Publication
Appointment

Selected highlights

Despite the health crisis that continued in 2021, the ETIS laboratory has demonstrated excellence and has again distinguished itself through awards, nominations, projects funded under PIA, 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.

- Inbar Fijalkow was elected as the **new President of Section 7** of the CoNRS (Section 07 : Sciences de l'information : signaux, images, langues, automatique, robotique, interactions, systèmes intégrés matériel-logiciel
<https://www.cnrs.fr/comitenational/sections/section.php?sec=07>)
- Participation of the team ICI in the **PEPR for 5G**. The team participated in multiple pre-proposals with I. Fijalkow, V. Belmega, I. Andriyanova, L. Luzzi, S. Berri and A. Chorti.
- **3 awards:**
 - Outstanding Student Paper Award for Sébastien Thomet, CELL, DFTS2021
 - Best Paper Award for Sylvain Colomer, NEURO-CELL, IROS2021
 - Best Paper Award for N. Myrtakis, BDA 2021
- **Start of the ESPADON** project (PIA/EquipEx+, 8,4 M€), with the WP Data co-led by Dan Vodislav, and the successful application of the MediaPat PhD project, funded by Fondation des Sciences du Patrimoine, focusing on the first steps in the design of the ESPADON data model, functional and system architectures.
- **Lola Cañamero in "50 Women in Robotics you need to know about 2021"**, <https://robohub.org/50-women-in-robotics-you-need-to-know-about-2021/>
- Journal paper published in **PLoS Computational Biology**, Alexandre Pitti, Mathias Quoy, Sofiane Boucenna, Catherine Lavandier. Brain-inspired model for early vocal learning and correspondence matching using free-energy optimization.
- **New graphical and identity chart**
- **New website**
- **Futurobot @ Cergy Pontoise organized by CNRS and ETIS**, 8th October 2021, www.futurobot-cergy.fr



Valorisation 2021

Partnerships

Spin-offs

Overview

 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. In 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.



International 2021

Joint Lab with IPAL

EUTOPIA

International
collaborations

Indicators 2021



1 thesis ongoing with
IPAL



59 ongoing
international
collaboration



5 PhD
EUTOPIA ongoing

Overview



*Project Manager
Lola Cañamero*

The international visibility of the unit is very good and has progressed in particular since 2017 as highlighted by the HCERES in 2019. Nevertheless, there is room for improvement. Thus, the ETIS laboratory has a proactive scientific policy to increase its international excellence in its fields of competence 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 2021, the laboratory had more than 59 active collaborations.



Main activities in 2021

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: Babeş-Bolyai University, Technische Universität Dresden, Ca' Foscari University of Venice, NOVA University Lisbon. Through the EUTOPIA alliance, the laboratory was able to initiate 5 PhD contracts in co-supervising (VUB, Warwick and Pompeu Fabra).

At the international level, actions to bring together IPAL (IRL based in Singapore), whose thematic fields are close to ETIS (in particular artificial intelligence and machine learning with their applications in data science, IoT, human-machine interaction, etc.) were initiated in March 2020. They led to the financing of several doctoral contracts with the financial support of INEX, A*STAR and NUS. A first PhD was initiated in 2021 (Matthieu Goriot). In parallel, the CNRS delegation of M. Quoy has been accepted in 2021, to join IPAL during the academic year 2021-2022. It will contribute to the rapprochement of ETIS to IPAL.

Equality and Parity

Missions
Activities in 2021

Equality Parity missions



*Project Manager
 Katerina Tzompanaki*

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

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:

- Raise awareness about parity problems in science-related professions, about biases, stereotypes, etc.
- Promote a spirit of collaboration, respect and tolerance among its members.
- Develop measures to encourage female students to continue in STEM related domains.
- Accompany and support female researchers after a maternity leave.
- Reward and promote the work of female researchers.

Main activities in 2021

- The Equality-Parity Charter of the ETIS members, written in French, English and Chinese.
- The book "Femme Scientifiques d'ETIS" (Women in Science at ETIS), and video (to be delivered in October 2022).
- 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).
- Organizing girls-only outings for the Master IISC-SIC students, and permanent and non-permanent members of ETIS (e.g., to the theatrical play: La machine de Turing).
- Supporting the Prix 2021 des Femmes et des Sciences pour CY Alliance <https://www.cyu.fr/cy-alliance-remise-du-prix-2021-%C2%AB-des-femmes-et-des-sciences-%C2%BB>

Communication and valorisation

Missions
Activities in 2021

Communication and valorisation missions



*Project Manager
Maria Malek*

ETIS is involved in several actions related to communication, dissemination, and science popularisation, ETIS researchers are encouraged to communicate about their research results and publications, 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 a wide audience.

ETIS maintains also a 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 improving the communication supports of the laboratory (flyer, web site, Kakemono, logo, templates, etc.), where work teams were formed to define these communication supports, the graphic charter was defined in collaboration the Neway Partners company.

Main activities in 2021

- The event Futurobot@Cergy Pontoise was organised by the CNRS and ETIS on the 8th October 2021: researchers from the Neuro team presented their research topics in the presence of an audience composed by high school students; this involved very interesting exchanges.
- Participation at the "Visites Insolites du CNRS": we welcomed 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. The presented themes were:
 - Humanoid robots on the school bench,
 - A laboratory apartment to study noise pollution,
 - 3D Modelling and virtual reality,
 - Smart embedded systems for Health Care platform,
 - Non-cooperative game theory.

Student Club

Overview
Activities in 2021

Overview



*Project Manager
Stéphane
Zuckerman*

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. Stéphane Zuckerman, Project Manager, supports the development of the activities.

The Club is managed by a few PhD students from ETIS at ENSEA (Clara Brémont, Théo Serru) and at Saint-Martin (Louis Annabi).

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

It 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 2021

In 2021, the Club supported the following activities:

- Organization of the "Annual Day of PhD" (review of the annual progress)
- Monthly seminar

08/01/2021	Xuan Son Nguyen	<i>Apprentissage profond sur la variété des matrices symétriques définies positives</i>
29/01/2021	Marie-Morgane Paumard	<i>"Ma thèse en vingt minutes : Reconstruire des puzzles archéologiques grâce au deep learning"</i>
26/02/2021	Clara Brémont	<i>"DeblurGAN-v2: Deblurring (Orders-of-Magnitude) Faster and Better"</i>
12/03/2021	Mathieu Goriot	<i>"Génération automatique de texte"</i>
01/04/2021	JDD	<i>Annual evaluation</i>
23/04/2021	Cecilia Tarpau + Ishak Ayad	<i>Deep learning-based artifact suppression for limited-angle tomography</i>

07/05/2021	Louis Regnacq	<i>Tutorial: a computational framework for the design and optimization of peripheral neural interfaces</i>
28/05/2021	Sylvain Coromer	<i>ORB-SLAM : A Versatile and Accurate Monocular SLAM System</i>
11/06/2021	Abdelouafi El Otmani + Trang Lam	<i>L'apprentissage profond appliqué au texte : le cas de l'attribution d'auteur et l'identification de l'ironie</i>
25/06/2021	Alexandre Pitti	<i>How to represent part-whole hierarchies in a neural networks</i>
15/10/2021	Loïc Jezequel	<i>Apprentissage de représentation par méthodes contrastives</i>
19/11/2021	Amine Khelif	<i>Security and privacy in Qi wireless charging</i>
10/12/2021	Veronica Belmega	<i>About fear when speaking in public</i>

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 2021

Arrivals

In 2021, the CELL team was joined by several associate researchers following integration of ex-EISTI School of Engineering within CY Tech as part of CY Paris Cergy University (officially created the 1st of January 2021), but also the creation of ESIEE-IT School of Engineering (former ITESCIA and ESIEE Cergy). Thus, plus Nga Nguyen who joined the CELL Team one year later, Juan Angel Lorenzo De Castillo and Sonia Yassa have been associated to the Reconfigurable Architecture axis, Amine Khelif (former PhD in the team) and Petr Dobias from ESIEE-IT have joined the Smart Embedded Systems axis as well as Stefan Borhofen, that moved from MIDI team to CELL team for scientific accordance in terms of research activities. A challenge for the team in 2021 and after is to ensure a good integration of their activities to make them possible to strengthen their scientific track record in articulation with the current activities of CELL first and in a second time to open new research interests in the year to come. In parallel, the team has also welcome new PhD students to strengthen the ongoing projects: Laure ACIN and Alexandre Bordat have joined the non-conventional sensors research activities, Thomas Couppey has started to work on the Interface Tissue/Implant project (funded by ANR and CNRS DEFI SENS and 80 Prime) since 2011 in the context of the pluridisciplinary mission) and Ihab Taleb will work on Security of Smart Grids architecture in isolated areas.

All these new arrivals in the CELL team are a real opportunity for the future activities that will be addressed and for identifying original research projects in the main domain that are Smart, Reliable and Communicating Embedded Systems.

Technological platforms

2021 was also a year where the teams strengthened its platform facilities.

- The platform "Atelier du mouvement" received multiple fundings from ENSEA, CYU, CNRS and DIM RFSI to have a fully equipped dedicated room at ENSEA. Infrared Camera, Event-Based sensors, UWB radar but also motion caption system, connected carpet, composed the different technical elements that can be used. This platform will be dedicated to movement analysis using non-conventional sensors with the underlying idea of proposing original smart cameras with related data processing schemes for several types of applications including fall detection for elderly people and analysis of the sportive gesture. This platform will be open to external collaboration including companies. It will also be a place to articulate joint work with MIDI and Neurocybernetics teams of ETIS.
- In parallel, an internship took place from September to February (2022) in order to accelerate the work on the IoT platform. Supported by several grants from ENSEA (SRV Call), CY, CNRS (through the intern Tremplin call for proposal), the structuration of the platform will make it possible to apply for more ambitious calls for project and to support the joint work with ICI team (PRCI Eliot among other projects). Juan Angel Lorenzo de Castillo in the context of the TREMPIN project has joined the project.

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 on recent topics of the team, are:

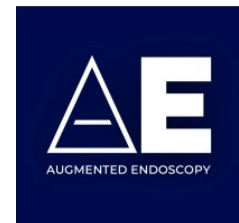
- Frontiers in Neuroscience: Clara Brémond Martin, Camille Simon Chane, Cedric Clouchoux, Aymeric Histace. Recent Trends and Perspectives in Cerebral Organoids Imaging and Analysis.
- International Journal of Parallel Programming: Tongsheng Geng, Marcos Amaris, Stéphane Zuckerman, Alfredo Goldman, Guang R. Gao & Jean-Luc Gaudiot. A Profile-Based AI-Assisted Dynamic Scheduling Approach for Heterogeneous Architectures.
- IEEE Access: S Iloga, A Bordat, J Le Kernec, O Romain, Human Activity Recognition based on acceleration data from smartphones using HMMs.
- BioCAS Conference: Louis Regnacq, Roland Giraud, Arianna Sanabria, Anil Thota, Laure Roversi, Morteza Rouhani, Laura Mcpherson, James Abbas, Ranu Jung, Olivier Romain, Sylvie Renaud, Yannick Bornat, Florian Kolbl, Evaluation of Stimulation Waveforms for Safe and Efficient Peripheral Nervous System Activation

- DFTS conference: M. A. Khelif, J. Lorandel and O. Romain, "Non-invasive I2C Hardware Trojan Attack Vector", in 34th IEEE International Symposium on Defect and Fault Tolerance in VLSI and Nanotechnology Systems.
- Springer Book: Jorge Bernal, Aymeric Histace. Computer-Aided Analysis of Gastrointestinal Videos, Springer International Publishing, 187 p., 2021, 978-3-030-64339-3.

Finally, the last (but not least) highlight for 2021 focuses on the award obtained by Sebastien Thomet (PhD student, CELL team, STMicro) during the 34th IEEE International Symposium on Defect and Fault (DFT) Tolerance in VLSI and Nanotechnology Systems: he was awarded the "Outstanding Student Paper Award" for his contribution entitled "FIRECAP: Fail-Reason Capturing hardware module for a RISC-V based System on a Chip".

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 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.



KPI of CELL in 2021

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 2021, the team was composed of the following members:
 - 21.5 permanents
 - 3 Full Professors (1 UCP, 2 ENSEA)
 - 11 Assistant Professor including 3 HDR
 - 5 Associate researchers from ESIEE-IT (2) and CY-Tech (3)
 - 1 PU-PH of the APHP-Saint Antoine Hospital
 - 1, ½ CNRS Engineers
 - 21 non-permanents:
 - 2 engineers/post-doc
 - 16 PhD students (all types of funding)

In – Out

- In :
 - Mohamed Amine Khelif, PhD, MCF ESIEE-IT associated to the ETIS Lab
 - Petr Dobias, PhD, Assistant Professor, ESIEE-IT associated to the ETIS Lab
 - Stefan Bornhofen, PhD, Assistant Professor, CY-Tech, associated to the ETIS Lab
 - Sonia Yassa, PhD, Assistant Professor, CY-Tech, associated to the ETIS Lab
 - Juan Angel Lorenzo De Castillo, CY-Tech, associated to ETIS Lab
 - Pierre Jacob, PhD - ATER
 - Laure Acin, PhD Candidate
 - Alexandre Bordat, PhD Candidate
 - Thomas Couppey, PhD Candidate
 - Ihab Taleb, PhD Candidate
- Out:
 - Habiba Lahdhiri, PhD – CYU. Now Assistant Professor at ESIEE-Paris
 - Pierre Lecoy, PU CentraleSupélec (retired)

New PhD

Name	Supervisor	Partner	Type	Start	Title
ACIN Laure	SIMON-CHANE HISTACE	ENSEA	ED	23/11/2021	Event-based camera,event-data processing,machine learning,table tennis,movement,tracking
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

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
JAKUPOV	ZEDDINI LONGHI ROMAIN	EXPERTIME	CIFRE	06/04/2020	From knowledge extraction to decision support: combining deep learning and NLP techniques
LEENHARDT	DRAY HISTACE	-	APHP	02/12/2019	Development of automated computer assisted diagnosis tool for small bowel capsule endoscopy.

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

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 vehicle
BESNIER	PICARD HISTACE	VALEO	CIFRE	21/11/2019	Safety of automotive systems using Machine Learning
COLOMER	CUPERLIER BRESSION ROMAIN	VEDECOM	CIFRE	05/11/2019	Integrated neuro-robotic approaches for autonomous vehicle localisation and navigation.
GIZZINI	HISTACE CHAFII	-	ED – ANR INEX	29/11/2018	Machine learning based channel estimation for high mobility vehicular communications
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

PhD Defended

Name	Supervisor	Partner	Type	Start	Date of defended	Length	Title
GIZZINI	HISTACE CHAFII	CY Initiative	Chaire ASIA	01/01/2019	03/12/2021	36 months	Techniques avancées d'estimation linéaire et d'apprentissage profond du canal dans des environnements doublement dispersifs
KHELIF	LORANDEL ROMAIN	IDEMIA, PJGN	R2S	01/10/2017	12/07/2021	45 months	Digital Architecture for Security Flaw Identification: Application to Forensics
LAHDHIRI	LORANDEL BOURDEL	-	INEX	01/11/2017	14/01/2021	38 months	Cognitive RF-NoC for manycore architectures

Publications (cf. HAL)

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
14	18	1	1 book chapter	1	2	3	3	

Publications with others teams of ETIS (cf. HAL)

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

1	5							
---	---	--	--	--	--	--	--	--

New contracts – funding

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
CIFRE BLULINEA	CNRS	CIFRE	ROMAIN	Delayed	3 years	15 000€	15 000€
HAAP INEX 2021 IPAL/A-STAR	CYU	ANR IDEX + IPAL	ROMAIN	01/01/2021	5 years	1 280 538€	345 000€
INTERFACE	CNRS	Ecole Thématique CNRS	ROMAIN	10/03/2021	9 months	7000€	7000€
AAP INS2I TREMLIN	CNRS	INS2I	ROMAIN	10/02/2021	10 months	4000€	4000€
FSP PATRIMA BOURSE SIMON-CHANE	CYU	Thesis	SIMON-CHANE / ROMAIN	01/09/2021	1 year	3714€	3714€
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€
PLATEFORME TEST RESEAUX	ENSEA	DIM RFSI	ROMAIN	01/04/2021	3 years	2 100€	2 100€
DOC ASSYST	ENSEA	CONTRAT DE PRESTATION	HISTACE	15/10/2021	4 months	12 000€	12 000€
Caractérisation du vivant par impédancemétrie	ENSEA	APPEL SRV	KOLBL	2021	1 year	4 570€	4 570€
SmartGait Atelier du mouvement	ENSEA	APPEL SRV	ROMAIN	2021	1 year	23 980€	23 980€
BIOTRACK	ANR	PRCI	ROMAIN	2021	3 years		

Ongoing contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
SMARTNET	ENSEA	Contrat de prestation	ROMAIN	01/10/2020	8 months	20 000€	20 000€
NEOXIA	ENSEA	CIFRE	HISTACE	01/04/2020	3 years	45 000€	45 000€
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€
SMARTSTIM	DR15	PRIME80, National Team Project	ROMAIN	12/02/2020	10 months	4 000€	4 000€
SMARTGAIT	DIM RFSI	Platform	ROMAIN	20/12/2020	12 months	27 720€	27 720€

DEEPTERA	CYU / University of Mauritius	Travel	HISTACE SIMON-CHANE	01/09/2020	12 months	20 000€	20 000€
INEX CARING	PIA	Post-doc	ROMAIN	01/07/2019	2 years	106 000€	106 000€
Reliability	St Microelectronic	Thesis CIFRE	GHAFFARI	03/12/2018	36 months	52 300€	52 300€
INEX SEEING	PIA	Thesis	KOLBL	01/02/2019	3 years – stopped in 2021	117 500€	117 500€
PHC Alliance	Campus France	Mobility	ROMAIN	21/12/2019	Reported until end 2022	2 400€	2 400€
BioTIF	ABR CRCNS	Thesis	ROMAIN KOLBK	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
GIANA 2021 (in conjunction with MICCAI 2021)	Challenge	Co-Organizer and Co-Chair	HISTACE	September 2021	Virtual
NPC 2021	Conference	Program Chair	ZUCKERMAN	November 2021	France - Hybrid (on-site, virtual)
INTERFACE	Thematic Winter School	Co-Organizer	ROMAIN	December 2021	France (ESIEE)
Medical Image Understanding and Analysis (MIUA) Conference 2021	Conference	Scientific Committee Member	HISTACE	July 2021	UK, Imperial College London
DFM21: 9th International Workshop on Data-Flow Models for Extreme-Scale Systems	Workshop	Chair	ZUCKERMAN	July 2021	Virtual
Congrès de la Société Française d'Optique	Conference	Program committee member	LECOY	July 2021	Dijon, France

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"

PhD and HDR juries

Name	Type	Role	Involved	Date	Where
FERREIRA Nicolas	PhD	Reviewer	ROMAIN	06/12/21	Univ Lyon

MASSIN Loïc	PhD	President	ROMAIN	26/11/21	IMT Atlantique / UBS
ARZEL Matthieu	HDR	Reviewer	ROMAIN	07/01/21	UBS

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

2021 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 2021

Journals

1. Abdul Karim Gizzini, Marwa Chafii, Ahmad Nimr, Raed Shubair, Gerhard Fettweis. CNN aided Weighted Interpolation for Channel Estimation in Vehicular Communications, *IEEE Transactions on Vehicular Technology, Institute of Electrical and Electronics Engineers*, vol. 70, no. 12, pp. 12796-12811, Dec. 2021, doi: 10.1109/TVT.2021.3120267.
2. Sylvain Iloga. Customizable HMM-based measures to accurately compare tree sets, *Pattern Analysis and Applications, Springer Verlag, Pattern Anal Applic* 24, 1149-1171 (2021). <https://doi.org/10.1007/s10044-021-00971-3>

3. Florian Kölbl, Yannick Bornat, Jonathan Castelli, Louis Regnacq, Gilles N'kaoua et al. *IC-Based Neuro-Stimulation Environment for Arbitrary Waveform Generation*, Electronics, Penton Publishing Inc., 2021, 10 (15), pp.1867
4. Clara Brémond Martin, Camille Simon Chane, Cedric Clouchoux, Aymeric Histace. *Recent Trends and Perspectives in Cerebral Organoids Imaging and Analysis*, Frontiers in Neuroscience, Frontiers, 2021, 15, pp.717.
5. Xavier Dray, Dimitris Iakovidis, Charles Houdeville, Jodrigio Jover, Dimitris Diamantis, Aymeric Histace et al. *Artificial intelligence in small bowel capsule endoscopy: Current status, challenges and future promise*, Journal of Gastroenterology and Hepatology, Wiley, 2021, 36 (1), pp.12-19.
6. Özgün Yılmaz, Camille Simon Chane, Aymeric Histace. *Evaluation of Event-Based Corner Detectors*, Journal of Imaging, MDPI, 2021, 7 (2), pp.25.
7. Charles Houdeville, Marc Souchaud, Romain Leenhardt, Hanneke Beaumont, Robert Benamouzig et al. *A multisystem-compatible deep learning-based algorithm for detection and characterization of angiectasias in small-bowel capsule endoscopy. A proof-of-concept study*, Digestive and Liver Disease, WB Saunders, 2021,
8. Romain Leenhardt, Ignacio Fernandez-Urien Sainz, Emanuele Rondonotti, Ervin Toth, Cedric van de Bruaene, Aymeric Histace, et al. *PEACE: Perception and Expectations toward Artificial Intelligence in Capsule Endoscopy*, Journal of Clinical Medicine, MDPI, 2021, Special Issue on Current and Emerging Technologies & Applications of Endoscopy in Clinical Practice, 10 (23), pp.5708 (Invited Paper)
9. S Iloga, O Romain, M Tchuente, *An efficient generic approach for automatic taxonomy generation using HMMs*, Pattern Analysis and Applications, 24, 243-262 (2021). <https://doi.org/10.1007/s10044-020-00918-0>
10. Zhou, B., Lin, Y., Le Kernec, J., Yang, S., Fioranelli, F., Romain, O. and Zhao, Z. (2021) *Simulation framework for activity recognition and benchmarking in different radar geometries*. IET Radar, Sonar and Navigation, 15(4), pp. 390-401
11. Tongsheng Geng, Marcos Amaris, Stéphane Zuckerman, Alfredo Goldman, Guang R. Gao & Jean-Luc Gaudiot. *A Profile-Based AI-Assisted Dynamic Scheduling Approach for Heterogeneous Architectures*. Int J Parallel Prog (2021).
12. S Mili, N Nguyen, R Chelouah, *Model driven architecture based security analysis*, Systems Engineering 24 (5), 307-321, 2021.
13. Daveau, C., Bornhofen, S., Khelifi, A., Naisseline, B. (2021). *Identification of deformable droplets from boundary measurements: the case of non-stationary Stokes problem*. Inverse Problems in Science and Engineering, 29:13, 3451-3474
14. S Iloga, A Bordat, J Le Kernec, O Romain, *Human Activity Recognition based on acceleration data from smartphones using HMMs*, IEEE Access 9, 139336-139351.

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. *Method and apparatus for real-time detection of polyps in optical colonoscopy*, Q Angermann, A Histace, X. Dray, O Romain, US Patent 11,017,526, 2021
2. *Device and method for producing a numerical classifier of images, so as to determine the viewing quality of the endoscopic videocapsule images of a segment of the digestive tube*, Xavier Dray, Aymeric Histace, US Patent 10,980,404.
3. *Method and Device for Human Activity Classification using Radar Micro-Doppler And Phase*, O. Romain and Julien Le Kernecl., EP21306742

Conference papers

1. Sylvain Colomer, Nicolas Cuperlier, Guillaume Bresson, Olivier Romain. *Forming a sparse representation for visual place recognition using a neurorobotic approach* ITSC 2021, Sep 2021, Indianapolis, United States
2. Franklin Cochachin, Laura Luzzi, Fakhreddine Ghaffari. *Reduced Complexity of a Successive Cancellation Based Decoder for NB-Polar Codes*, 2021 11th International Symposium on Topics in Coding (ISTC), Aug 2021, Montreal, Canada. pp.1-5, (10.1109/ISTC
3. Loic Jezequel, Ngoc-Son Vu, Jean Beaudet, Aymeric Histace. *Fine-grained Anomaly Detection via Multi-task Self-Supervision*, AVSSP 2021, IEEE, Nov 2021, Washington (Virtual), United States
4. Xavier Dray, Romain Leenhardt, Marc Souchaud, Guy Houist, Jp Le Mouel et al. *Développement et validation d'une solution d'intelligence artificielle pour évaluer la qualité de la préparation intestinale en vidéocapsule endoscopique du grêle*, Journées françaises d'Hépatogastroentérologie et d'Oncologie digestive (JFHOD'21), Mar 2021, Paris, France
5. Charles Houdeville, Marc Souchaud, Romain Leenhardt, Hanneke Beaumont, Robert Benamouzig et al. *KILLING TWO BIRDS WITH ONE STONE: THE FIRST MULTISYSTEM-COMPATIBLE, ARTIFICIAL INTELLIGENCE SOLUTION FOR SMALL-BOWEL CAPSULE ENDOSCOPY*, UEG Week, Oct 2021, Virtual, Austria
6. Abdul Karim Gizzini, Marwa Chafii, Shahab Ehsanfar, Raed Shubair. *Temporal Averaging LSTM-based Channel Estimation Scheme for IEEE 802.11p Standard*, IEEE Global Communications Conference, Dec 2021, Madrid, Spain
7. Théo Serru, Kevin Delmas. *A Comprehensive Probabilistic Assessment Method of UAS Ground Collision Risk*, Proceedings of the 31st European Safety and Reliability Conference (ESREL), Sep 2021, Angers, France. pp.38-45.
8. S. Thomet et al., "FIRECAP: Fail-Reason Capturing hardware module for a RISC-V based System on a Chip," 2021 IEEE International Symposium on Defect and Fault Tolerance in VLSI and Nanotechnology Systems (DFT), 2021, pp. 1-6, doi: 10.1109/DFT52944.2021.9568317.
9. S Colomer, N Cuperlier, G Bresson, O Romain, *Hierarchical Sparse Dictionaries: how sparsity, topology and pooling can improve visual place recognition*, Human-like Behavior and Cognition in Robots-workshop, IROS conference 2021.
10. Louis Regnacq, Roland Giraud, Arianna Sanabria, Anil Thota, Laure Roversi, Morteza Rouhani, Laura Mcpherson, James Abbas, Ranu Jung, Olivier Romain, Sylvie Renaud, Yannick Bornat, Florian Kolbl, *Evaluation of Stimulation Waveforms for Safe and Efficient Peripheral Nervous System Activation*, 2021 Biomedical Circuits and Systems Conference (BioCAS 2021)
11. Zhang, X., Abbasi, Q., Fioranelli, F. , Romain, O. and Le Kernecl, J. (2021) *Elderly care - human activity recognition using radar with an open dataset and hybrid maps*. In: EAI BODYNETS 2021 - 16th EAI International Conference on Body Area Networks: Smart IoT and big data for intelligent health management, Glasgow, Great Britain, 25-26 October 2021.
12. L Regnacq, R Giraud, G N'Kaoua, S Renaud, R Jung, J Abbas, F Kolbl, Y Bornat, N Lewis, O Romain, *A model/hardware framework for arbitrary waveform stimulation of peripheral nerve fibers*, Neuro France 2021.
13. Z Li, J Le Kernecl, F Fioranelli, O Romain, L Zhang, S Yang, *An LSTM Approach to Short-range personnel recognition using Radar Signals*, 2021 IEEE Radar Conference (RadarConf21), 1-6
14. Li, Z., Le Kernecl, J. , Fioranelli, F. , Abbasi, Q. , Yang, S. and Romain, O. *Human Activity Classification with Adaptive Thresholding using Radar Micro-Doppler*. In: 2021 CIE International Conference on Radar (CIE Radar 2021), Haikou, Hainan, China, 15 - 19 December 2021.

15. Yang, K., Abbasi, Q. H. , Fioranelli, F. , Romain, O. and Le Kernec, J. *Bespoke Simulator for Human Activity Classification with Bistatic Radar*. In: *16th EAI International Conference on Body Area Networks (EAI BODYNETS 2021)*, Glasgow, UK, 25-26 Oct 2021, pp. 71-85. ISBN 9783030955922 (doi: 10.1007/978-3-030-95593-9_7)
16. Zhang, X., Abbasi, Q. H. , Fioranelli, F. , Romain, O. and Le Kernec, J. *Elderly Care – Human Activity Recognition Using Radar with an Open Dataset and Hybrid Maps*. In: *16th EAI International Conference on Body Area Networks (EAI BODYNETS 2021)*, Glasgow, UK, 25-26 Oct 2021, pp. 39-51. ISBN 9783030955922 (doi: 10.1007/978-3-030-95593-9_4)
17. M. A. Khelif, J. Lorandel and O. Romain, "Non-invasive I2C Hardware Trojan Attack Vector", in *34th IEEE International Symposium on Defect and Fault Tolerance in VLSI and Nanotechnology Systems (DFTS'21)*, 6-8 oct. 2021.
18. Daveau, C., Kacem, M., Oueslati, S., Bornhofen, S. (2021). *Photonics and Electromagnetics Research Symposium (PIERS)*.

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 two main interfaces between the research conducted by the team ICI and other teams in ETIS. First with the team CELL, there are common ongoing works in three topics, namely on Internet of things networks, on coding (LDPC and Polar) and finally on security. Secondly, there are topics on artificial intelligence of common interest with the team MIDI and this aspect could be strengthened in the future.

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.
- 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.
- Tomography and Emerging Imaging: new concepts, associated inverse problems and artificial intelligence (AI)-based approaches.

The research area of post-quantum cryptography was reinforced with the recruitment of a new lecturer (fixed-term contract), Dr. Kévin Carrier, with a strong background in code-based cryptography.

Highlights in 2021

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

- Inbar Fijalkow was elected as the new President Section 7 of the CoNRS (Section 07 : Sciences de l'information : signaux, images, langues, automatique,

robotique, interactions, systèmes intégrés matériel-logiciel
<https://www.cnrs.fr/comitenational/sections/section.php?sec=07>)

- Arsenia Chorti created and chairs the IEEE Physical Layer Security Focus Group, as part of IEEE INGR on Security, with more than 40 internationally renowned academic members and industry partners.
- Mai K. Nguyen-Verger heads the international inter-team activity "Emerging Imaging", between four CNRS laboratories: ETIS-UMR 8051, LPTM-UMR 8089 (Theoretical Physics and Modeling), AGM-UMR 8088 (Geometric Analysis and Modeling) and LMV-UMR 8100 (Mathematics of Versailles) belonging to three institutes (INS2I, INP, INSMI) and the Centro de Matematica Aplicada, Universidad Nacional de San Martin, Buenos Aires, Argentina. This activity involves 8 members (3 PR, 2 MCF, 1 researcher, 2 PhD students), 9 projects and publications of 7 international journal articles, 15 conferences including 6 invitations.
- Veronica Belmega received the Prix 2021 des Femmes et des Sciences of CY Alliance <https://www.cyu.fr/cy-alliance-remise-du-prix-2021-%C2%AB-des-femmes-et-des-sciences-%C2%BB>
- Participation of the team ICI in the PEPR for 5G, with Arsenia Chorti being CNRS representative for project 6. The team participated in multiple pre-proposals with I. Fijalkow, V. Belmega, I. Andriyanova, L. Luzzi, S. Berri and A. Chorti.

Despite the travel restrictions due to covid, team members managed to host one international guest from Warwick University, Dr. S. Lakshminarayana.

KPI of ICI in 2021

Members

As of 31st December 2021, the ICI Group has:

- 14 permanent members:
 - 4 Full Professors
 - 7 Assistant Professors
 - 2 Full CNRS Researchers – CR
- 19 non-permanent members:
 - 6 associates (Marwa Chafii, Rachid Chelouah, Astrid Jourdan, Lylia Alouache, Kévin Carrier, Marc Fossorier)
 - 17 PhD Students registered at the ED of CYU and a further 9 registered at other EDs but supervised by ICI members
 - 3 postdocs and ATER

Publications

<i>Journal</i>	<i>Conferences</i>	<i>National</i>	<i>Dissemination</i>	<i>Book</i>	<i>Chapter</i>	<i>Patent</i>	<i>Thesis</i>	<i>Others</i>
24	28	2		1	3		5	

Publications with others teams of ETIS

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
	1							

Ongoing PhD

15 PhD students are registered with the ED CYU and further 9 PhD students are co-supervised by team members and registered in a different doctoral school.

Name	Supervisor	Partner	Type	Start	Title
ALI	ANDRIYANOVA	ECOBIOH2	ED - ADEME	11/02/2019	Energy-aware Green Data Center Network and Job Scheduling
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
BELLO	FIJALKOW CHORTI	-	ED	01/11/2019	Meeting delay and security constraints in sixth generation (6G) wireless networks
BOU ROUPHAEL	FIJALKOW LE TREUST	-	INEX - COSA	01/10/2019	Strategic Coordination of Autonomous Devices: Interplay between Information Theory and Game Theory
BOUETTE	WANG LUZZI	-	INEX - PHEBE	01/11/2021	Information and coding-theoretic study of covert communication
DESPORTES	FIJALKOW ANDRY	ECOBIOH2	ED - ADEME	09/10/2018	Learning, Forecasting and optimization of energy supply for a low environmental impact building
EL HASSANI	BELMEGA SAVARD	IMT Lille	ED - ANR Eliot	01/10/2019	Energy-efficient IoT networks
MALEKI	BELMEGA LAKSHMINA RAYANA	WARWICK	EUTOPIA COFUND WALL-EE	11/11/2021	Wide-area Adaptive control in IntelLigent cyber-physical power systems exploiting dEEP reinforcement learning
MOKNI	CHELOUAH NAZIH	-	MESR - Tunisie	01/09/2018	workflow scheduling on cloud-fog computing
BOUSHAMA	CHELOUAH MAACHAOUI	Co-TUTELLE ALGÉRIE	MESR ALGÉRIEN	01/09/2015	Security in ubiquitous networks
REZGUI	FIJALKOW ANDRIYANOVA	-	ED - ANR MUSICO	01/10/2017	Coded Modulations for Optical Communication Under High-Throughput, Latency and Complexity Constraints
ROSSEEL	FIJALKOW SAVIN	CEA	ED - CEA	05/10/2020	POWER EFFICIENT AI-BASED IOT PHYSICAL LAYER
SALIBA	FIJALKOW LUZZI	-	ED - INEX	28/09/2017	Lattice hash functions for secret key generation.
TARPAU	NGUYEN-VERGER DUMAS	UVSQ	DIM Math INNOV Labex MME-DII	01/11/2018	A new modality of Compton Scattering Tomography: concept, modelling and associated inverse problems

Inter-team ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
GIZZINI	HISTACE CHAFII	-	ED - ANR INEX	29/11/2018	Machine learning based channel estimation for high mobility vehicular communications

SASSI	NGUYEN CHELOUAH	PJGN	PJGN	19/09/2019	Artificial intelligence for intrusion detection via connected objects
-------	--------------------	------	------	------------	--

PhD Defended

Name	Supervisor	Partne r	Type	Start	Defended	Length	Title
REZGUI	FIJALKOW/ ANDRIYANOV A	-	ED – ANR MUSICO	01/10/2017	14/12/2021	4 years (includin g maternity leave)	Coded Modulations for Optical Communication Under High- Throughput, Latency and Complexity Constraints
TARPAU	NGUYEN- VERGER DUMAS	UVSQ	ED – Labex MME-DII	01/11/2018	07/12/2021	3 years	A new modality of Compton Scattering Tomography: concept, modelling and associated inverse problems
GIZZINI	HISTACE CHAFII	-	ED – ANR INEX	29/11/2018	03/12/2021	3 years	Techniques avancées d'estimation linéaire et d'apprentissage profond du canal dans des environnements doublement dispersifs
MOKNI	CHELOUAH NAZIH	-	MESR - Tunisie	01/09/2018	16/12/2021	3 years	Ordonnancement des workflows dans Cloud-Fog computing
BOUSHAM A	CHELOUAHM AACHAOUI	Co- TUTEL LE ALGÉRI E	MESR ALGÉRIEN	01/09/2015	02/12/2021	6 years	Confiance dans les réseaux véhiculaires Ad- Hoc.

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 INS2I/ DELICATE	CNRS	INS2I	BERRI	10/02/2021	10 months	8000€	8000€

AYAD	DIM Math INNOV	Thesis	NGUYEN-VERGER	2021	3 years	118.620 € (CY)	-
APPEL SRV	ENSEA	Prof invité	BELMEGA	2021	14 days	2 100€	2 100€
WALL-EE	EUTOPIA	COFUND	BELMEGA	2021	4 years	71k GBP + 9.9k GBP for mobility (Warwick)	-
CEBEIRO	CY Advanced Studies	Prof invité	NGUYEN-VERGER	2021	1 year	2730€	2 730€

Ongoing contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
POTIONS	ENSEA	CONTRAT DOCTORAL	BELMEGA	01/10/2020	3 years	93 000€	93 000€
PROCOPE 2020-2021	ENSEA	PHC Mobilité france allemagne	CHORTI	01/01/2020	24 months	14 000€	14 000€
CEA TECH	ENSEA	PhD	FIJALKOW	19/10/2020	3 years	0 €	0 €
SAFEST	ENSEA	DIM RFSI	CHORTI	19/03/2019	2.5 years	27 500€	27 500€
QCSP	ENSEA	ANR	LUZZI	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€
ECOBIOH ₂	ENSEA	ADEME	FIJALKOW	17/05/2018	4.5 years	580 149€	457 708€
INEX Lattice hash functions	INEX	Thesis	LUZZI	01/10/2017	3 years and 10 months	112 500€	112 500€
CHAIRE ASIA	ENSEA	INEX AAP CHAIRE	CHAFII	01/09/2018	4 years	216 000€	216 000€
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 €
Security in Distributed Inference	PHC Maimonide	Travels	WANG	01/10/2019	2 years	130,000 €	64 000€
eNiGMA	INEX	Post-Doc	CHORTI	01/01/2020	2 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€
TARPAU	Labex MMEDII et DIM MathInnov	Thesis	NGUYEN-VERGER	01/10/2018	30/09/2021	52 500€ (CY) et 48 600€ (CY)	52 500€ et 48 600€
PHC MAIMONIDE	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/CY U)	0€
AXLR	ETIS/LPTM		NGUYEN	2021		10 000€	9 000€

Scientific Dissemination

Event Organization

- S. Reynal organized the regular "Seminaire fil rouge" of the ETIS lab on the theme of security
- A. Chorti organized the Special Sessions "Selected topics on 6G security", IEEE ISWCS, Sep. 2021, Berlin, Germany and "Statistical Methods for IoT", IEEE SSP 2021, Jul. 2021, Rio de Janeiro, Brazil

Invited Professors

- Subhash Lakshminarayana from Univ. of Warwick, UK visited V. Belmega (August 23-September 3)

Guest and Associate Editors

- M. Le Treust is an Associate Editor for Security and Privacy, IEEE Transactions on Information Theory (since Oct. 2021)
- L. Wang is an Associate Editor for Shannon Theory, IEEE Transactions on Information Theory (since Oct. 2019).
- A. Chorti is an Associate Editor of the Open Journal of Signal Processing society (OJSP)

TPCs

- V. Belmega was TPC for the conferences IEEE SPAWC, IEEE WCNC, IEEE PIMRC, IEEE 5G World Forum
- I. Fijalkow was TPC for the conferences IEEE WCNC, IEEE Globecom, IEEE ICC
- A. Chorti was TPC for the conferences IEEE WCNC, IEEE Globecom, IEEE ICC

Prizes and distinctions

- V. Belmega won the award "Prix CY Alliance: For Women and Science" 2021

National and local scientific responsibilities

- V. Belmega DUA (Deputy Director) of ETIS
- V. Belmega participated to an Associate Professor hiring committee (CoS) at ESIEE-IT
- A. Chorti was Chair of the IEEE Focus Group on Physical Layer Security
- A. Chorti was a Member of the Comité de Pilotage of Systematic
- A. Chorti was a Member of the Jury des Prix des Theses, ISIS/Gretsi/EEA
- I. Fijalkow was elected President of the Section 7 of CoNRS
- Mai K. Nguyen is Vice-President of the Commission de Recherche and member of the Conseil d'Administration of the club EEA.
- Mai K. Nguyen is a member of the Council of the Institute of Science and Technology (IST), CY Tech, CY Cergy Paris University

International scientific responsibilities

- A. Chorti was an expert evaluator of EPSRC proposals (UK)

- V. Belmega was a research project expert for the São Paulo Research Foundation (FAPESP), Brazil
- Mai K. Nhuyen-Verger was project expert for ANR PRCI 2021.

Invited Talks

- Mai K. Nguyen, "Radon transforms on circular arcs and their imaging applications», *The 7th international conference "Quasilinear Equations, Inverse Problems and their Applications", Moscow, August 23 to 29, 2021. (Invited Plenary Talk).*
- A. Chorti, 46th WWRF 2021, "Towards context aware 6G security, incorporating the PHY", Dec. 2021
- A. Chorti, IEEE UAE Distinguished Seminar Series, "Towards Context Aware 6G Security: The Role of the Physical Layer", Nov. 2021
- A. Chorti, Tutorial on "Statistical methods in physical layer security", IEEE Statistical Signal Processing (SSP) Workshop, July 2021, Rio de Janeiro, BR
- A. Chorti, Panellist in "Birds of a Feather" IEEE INGR Future Network Security: Challenges & Opportunities Workshop, Panel Session on Future Security, Mar. 2021

Research perspectives for 2022

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
- semantic communications
- privacy and trustworthiness
- waveform design for 6G
- code-based cryptography, lattice based signatures
- emerging imaging and hybrid representation

Publications 2021

Journals

1. J. Pedersen, A. G. i Amat, J. Goseling, F. Brännström, I. Andriyanova and E. Rosnes, "Dynamic Coded Caching in Wireless Networks," in *IEEE Transactions on Communications*, vol. 69, no. 4, pp. 2138-2147, April 2021.
2. S. Lakshminarayana, E.V. Belmega, and H. V. Poor, "Moving-Target Defense Against Cyber-Physical Attacks in Power Grids via Game Theory", *IEEE Trans. on Smart Grids*, vol. 12, no. 6, pp. 5244 - 5257, Nov. 2021.
3. H. El Hassani, A. Savard, and E.V. Belmega, "Adaptive NOMA in time-varying wireless networks with no CSIT/CDIT relying on a 1-bit feedback", *IEEE Wireless Commun. Lett.*, vol. 10, no. 4, pp. 750-754, Apr. 2021.
4. A. W. Azim, Y. Le Guennec, M. Chafii and L. Ros, "LACO-OFDM With Index Modulation for Optical Wireless Systems," in *IEEE Wireless Communications Letters*, vol. 10, no. 3, pp. 664-667, March 2021, doi: 10.1109/LWC.2020.3045119.
5. K. Zerhouni, E. M. Amhoud and M. Chafii, "Filtered Multicarrier Waveforms Classification: A Deep Learning-Based Approach," in *IEEE Access*, vol. 9, pp. 69426-69438, May 2021.

6. P. H. C. De Souza, L. L. Mendes and M. Chafii, "Compressive Learning in Communication Systems: A Neural Network Receiver for Detecting Compressed Signals in OFDM Systems," in *IEEE Access*, vol. 9, pp. 122397-122411, August 2021.
7. R. Bomfin, A. Nimr, M. Chafii and G. Fettweis, "A Robust and Low-Complexity Walsh-Hadamard Modulation for Doubly-Dispersive Channels," in *IEEE Communications Letters*, vol. 25, no. 3, pp. 897-901, March 2021.
8. R. Bomfin, M. Chafii, A. Nimr and G. Fettweis, "A Robust Baseband Transceiver Design for Doubly-Dispersive Channels," in *IEEE Transactions on Wireless Communications*, vol. 20, no. 8, pp. 4781-4796, Aug. 2021.
9. A. Karim Gizzini, M. Chafii, A. Nimr, R. M. Shubair and G. Fettweis, "CNN Aided Weighted Interpolation for Channel Estimation in Vehicular Communications," in *IEEE Transactions on Vehicular Technology*, vol. 70, no. 12, pp. 12796-12811, Dec. 2021.
10. I. Bizon Franco de Almeida, M. Chafii, A. Nimr and G. Fettweis, "Alternative Chirp Spread Spectrum Techniques for LPWANs," in *IEEE Transactions on Green Communications and Networking*, vol. 5, no. 4, pp. 1846-1855, Dec. 2021, doi: 10.1109/TGCN.2021.3085477.
11. C. Lamoureux and R. Chelouah, *Fusion Particle and Fingerprint recognition for Indoor Positioning, Engineering Applications of Artificial Intelligence* 98, January 2021
12. M. Mokni, S. Yassa, J. Hajlaoui, R. Chelouah and M. Nazih Omri, *Cooperative Agents-based approach for Workflow Scheduling on Fog-Cloud computing, Journal of Ambient Intelligence and Humanized Computing, Springer*, April 2021.
13. Saoussen Mili, Nga Nguyen and Rachid Chelouah, *Model-Driven Architecture Based Security Analysis, Systems Engineering Wiley*, May 2021.
14. W. Nijima, M. Chafii, A. Chorti, R. Shubair, H.V. Poor, "Indoor Localization using Data Augmentation via Selective Generative Adversarial Networks", *IEEE Access*, vol. 29, 2021.
15. M. Mitev, A. Chorti, V. Belmega, V. Poor, "Protecting Physical Layer Secret Key Generation from Active Attacks", invited paper, *Entropy, Special Issue on Physical-Layer Security, Quantum Key Distribution and Post-quantum cryptography*, July 2021.
16. L. Desportes, I. Fijalkow, P. Andry, *Deep Reinforcement Learning for Hybrid Energy Storage Systems: Balancing Lead and Hydrogen Storage, Energies, special issue on Machine Learning and Deep Learning for Energy*, August 2021
17. M. Le Treust, and M. Bloch, *State Leakage and Coordination with Causal State Knowledge at the Encoder, IEEE Transactions on Information Theory, Volume: 67, Issue: 2, Pages 805-823, Feb. 2021.*
18. Cécilia Tarpau, Javier Cebeiro, Geneviève Rollet, Mai K. Nguyen and Laurent Dumas, « Analytical reconstruction formula with efficient implementation for a modality of Compton scattering tomography with translational geometry », *Inverse Problems and Imaging*, 2021. doi:10.3934/ipi.2021075 .
19. J. Cebeiro, C. Tarpau, M. A. Morvidone, D. Rubio and M. K. Nguyen, «On a three-dimensional Compton scattering tomography system with fixed source», *Inverse Problems, Special issue on Modern Challenges in Imaging*, 37(2021), 054001 (23pp) , 2021. <https://doi.org/10.1088/1361-6420/abfofo>.
20. L. Wang, "Covert Communication Over the Poisson Channel," *IEEE Journal on Selected Areas in Information Theory*, vol. 2 no. 1, pp. 23-31, Mar. 2021.
21. S. Gelincik, M. Wigger, and L. Wang, "Benefits of Local Cooperation in Sectorized Cellular Networks Under a Complexity Constraint" *IEEE Transactions on Wireless Communications*, vol. 20 no. 6, pp. 3897-3910, June 2021.
22. Hirah Malik, Cédric Adjih, Claudio Weidmann, Michel Kieffer, « MICN: a Network Coding Protocol for ICN with Multiple Distinct Interests per Generation », *Computer Networks, Elsevier*, vol 187, March 2021
23. F. Cochachin, E. Boutillon and D. Declercq, "Sign-Preserving Min-Sum Decoders", *IEEE Transactions on Communications*, 2021, 69 (10), pp. 6439-6454.
24. S. Reynal, « Entre processus stochastiques et métriques d'évaluation : l'IA-créatrice à l'épreuve de l'étrangeté », *Philosophy Kitchen. Rivista di filosofia contemporanea*, n. 14, pp. 101-115, 2021

International conferences

1. G. Rezgui, I. Andriyanova, A. Maalaoui, C. Poulliat, "A class of non-binary doubly-generalized LDPC codes for moderate and high code rates", *IEEE International Symposium on Information Theory (ISIT)*, 96-100, 2021
2. H. El Hassani, A. Savard, E. V. Belmega, and R. C. de Lamare, "Energy-efficient Cooperative Backscattering Closed-Form Solution for NOMA", *IEEE GLOBECOM*, Dec. 2021.
3. H. El Hassani, A. Savard, and E.V. Belmega, "Energy-efficient 1-bit feedback NOMA in wireless networks with no CSIT/CDIT", *IEEE SSP workshop*, Jul. 2021.
4. I. Chafaa, R. Negrel, E.V. Belmega, and M. Debbah, "Federated channel-beam mapping: from sub-6GHz to mmWave", *IEEE WCNC, Workshop on Distributed Machine Learning for Future Communications and Networking*, Mar. 2021.
5. K. Antonakopoulos, E. V. Belmega, and P. Mertikopoulos, "Adaptive extra-gradient method for Min-Max optimization and games", *ICLR, 9th Intl. Conf. on Learning Representations* Jan. 2021.
6. S. Berri, K. Hijja, and H. Labiod, "Slicing-Based Offloading in Vehicular Edge Computing", *IEEE International Conference on High Performance Switching and Routing (HPSR)*, Paris, France, 7-9 June. 2021.
7. R. Bomfin, M. Chafii, A. Nimr and G. Fettweis, "Channel Estimation for MIMO Space Time Coded OTFS under Doubly Selective Channels," *2021 IEEE International Conference on Communications Workshops (ICC Workshops)*, June 2021.
8. E.-M. Amhoud, M. Chafii, A. Nimr and G. Fettweis, "OFDM with Index Modulation in Orbital Angular Momentum Multiplexed Free Space Optical Links," *2021 IEEE 93rd Vehicular Technology Conference (VTC2021-Spring)*, June 2021.
9. W. Njima, M. Chafii, A. Nimr and G. Fettweis, "Convolutional Neural Networks based Denoising for Indoor Localization," *2021 IEEE 93rd Vehicular Technology Conference (VTC2021-Spring)*, June 2021.
10. A. Belen Martinez, A. Kumar, M. Chafii and G. Fettweis, "Sequence Design for Frame Detection Based on Autocorrelation," *2021 IEEE 93rd Vehicular Technology Conference (VTC2021-Spring)*, June 2021.
11. A. K. Gizzini, M. Chafii, S. Ehsanfar and R. M. Shubair, "Temporal Averaging LSTM-based Channel Estimation Scheme for IEEE 802.11p Standard," *2021 IEEE Global Communications Conference (GLOBECOM)*, December 2021.
12. I. B. F. de Almeida, M. Chafii, A. Nimr and G. Fettweis, "Blind Transmitter Localization in Wireless Sensor Networks: A Deep Learning Approach," *2021 IEEE 32nd Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC)*, 2021, pp. 1241-1247.
13. M. I. AlHajri, R. M. Shubair and M. Chafii, "Indoor Localization Under Limited Measurements: A Cross-Environment Joint Semi-Supervised and Transfer Learning Approach," *2021 IEEE 22nd International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, September 2021.
14. M. Shakiba Herfeh, L. Luzzi, A. Chorti, "Finite Blocklength Secrecy Analysis of Polar and Reed-Muller Codes in BEC Semi-Deterministic Wiretap Channels", *Proc. IEE Inf. Theory Workshop (ITW)*, 2021.
15. M. Srinivisan, S. Skaperas, A. Chorti, "On the Use of CSI for the Generation of RF Fingerprints and Secret Keys", in *Proc. WSA*, Nov. 2021.
16. M. Shakiba Herfeh, A. Chorti, "Comparison of Short Blocklength Slepian Wolf Coding for Reconciliation", in *Proc. IEEE SSP*, Jul. 2021.
17. G.A. Nunez Segura, A. Chorti, C. Borges Margi, "Centralized or Distributed DoS Attack Detection? Tradeoffs in Resource Constrained Networks", in *Proc. IEEE SSP*, Jul. 2021.
18. N. Ferdosian, S. Skaperas, A. Chorti, L. Mamatras, "Near Optimal Linear Complexity Scheduling of Heterogeneous Services by Resolving Conflicts", in *Proc. ICC Workshops* 2021.

19. A Mezghani, D Plabst, LA Swindlehurst, I Fijalkow, JA Nossek, « Sparse Linear Precoders for Mitigating Nonlinearities in Massive MIMO », IEEE SSP 2021
20. J. Rosseel, V Mannoni, V Savin, I Fijalkow, "Error Structure Aware Parallel BP-RNN Decoders for Short LDPC Codes", IEEE ISTC
21. R. Bou Rouphael, and M. Le Treust, Strategic Successive Refinement Coding for Bayesian Persuasion with Two Decoders, IEEE Information Theory Workshop (ITW), Kanazawa, Japan, 2021.
22. M. Le Treust, and T. Oechtering, Continuous Random Variable Estimation is not Optimal for the Witsenhausen Counterexample, IEEE Information Symposium on Information Theory (ISIT), Melbourne, Australia, 2021.
23. M. Le Treust, and T. Tomala, Strategic Communication with Decoder Side Information, IEEE Information Symposium on Information Theory (ISIT), Melbourne, Australia, 2021.
24. R. Bou Rouphael, and M. Le Treust, Impact of Private Observation in Bayesian Persuasion, International Conference on NETWORK Games COntrol and oPTimization (NETGCOOP), Cargèse, Corsica, Sept. 2021.
25. C. Saliba, L. Luzzi, C. Ling, "A reconciliation approach to key generation based on Module-LWE", IEEE International Symposium on Information Theory, Melbourne, Australia, July 2021
26. F. Cochachin, L. Luzzi, F. Ghaffari, "Reduced Complexity of a Successive Cancellation Based Decoder for NB-Polar Codes", International Symposium on Topics in Coding (ISTC), Montreal, Canada, August-September 2021
27. Ishak Ayad, Cécilia Tarpau, Mai K. Nguyen and Ngoc Son Vu , « Deep morphological network-based artifact suppression for limited-angle tomography», 25th International Conference on Image Processing, Computer Vision and Pattern Recognition (IPCV'21), Las Vegas, USA, July 26-29, 2021.
28. Y. Kochman and L. Wang, "On the Communication Exponent of Distributed Testing for Gaussian Correlations," in Proceedings of 2020 IEEE Information Theory Workshop, Riva del Garda, Italy, 11-15 Apr. 2021.

National conferences

1. W. Njima, M. Chafii, R. M Shubair, « GAN Based Data Augmentation for Indoor Localization Using Labeled and Unlabeled Data ", Fourth International Balkan Conference on Communications and Networking (BalkanCom 2021), Sep 2021, Novi Sad, Serbia.
2. S. Reynal, « Pour qu'on ne se débarrasse pas des hommes : entre art et sciences, l'ingénieur face à l'ambivalence du sujet ». Conférence Drôles d'objet, La Rochelle, 27-29 Octobre 2021.

Books

1. R. Chelouah and P. Siarry, Optimization and Machine learning, ISTE-WILEY, 2021

Book chapters

1. Ahmad Nimr; Zhongju Li; Marwa Chafii; Gerhard Fettweis, "Generalized Frequency Division Multiplexing: Unified Multicarrier Framework," in Radio Access Network Slicing and Virtualization for 5G Vertical Industries , IEEE, 2021, pp.63-82.
2. M. Shakiba Herfeh, A. Chorti, V.H. Poor, A Review of Recent Results on Physical Layer Security, Springer Nature Jan. 2021.
3. S. Reynal, "Numéricité, Complexité et échelles de temps dans la pratique artistique contemporaine". In J. Féral (Ed.), Changements d'échelle : les arts confrontés au réel. Milan: Mimesis, Collection Images, Medium, 17, 255, 2021

Science and society

1. A. Chorti, *Invited Podcast at MySecurity MarketPlace, with Jane Lo, Singapore correspondent, "6G a paradigm shift and physical layer security", Sep. 2021*
2. C. Weidmann, *audiovisual installation "Da(t)ti al Paradisio", presented at the Art and Science festival "Teatri del suono", Trieste (Italy), October 30th-November 1st of 2021.*

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.

Highlight

Awards and distinctions

- BDA 2021 Best Paper Award "On Predictive Explanation of Data Anomalies", Myrtakis, N., Tsamardinos, I., & Christophides, V.

Top publications

- Diogo Luvizon, David Picard, Hedi Tabia. Multi-task Deep Learning for Real-Time 3D Human Pose Estimation and Action Recognition. IEEE Transactions on Pattern Analysis and Machine Intelligence, Institute of Electrical and Electronics Engineers, 2021, 43 (8), pp.2752--2764. {10.1109/TPAMI.2020.2976014}. {hal-02558843} - core A* journal.
- Xuan Son Nguyen. GeomNet: A Neural Network Based on Riemannian Geometries of SPD Matrix Space and Cholesky Space for 3D Skeleton-Based Interaction Recognition. ICCV 2021: 13359-13369 {hal-03720244} - core A* journal
- Vasilis Efthymiou, Kostas Stefanidis, Evaggelia Pitoura, Vassilis Christophides. FairER: Entity Resolution With Fairness Constraints. 30th ACM International Conference on Information & Knowledge Management (CIKM '21), Nov 2021, New York, France. {10.1145/3459637.3482105}. {hal-03608623} - top core A conference
- Nikolaos Myrtakis, Vassilis Christophides, Eric Simon. A Comparative Evaluation of Anomaly Explanation Algorithms. 24th International Conference on Extending Database Technology (EDBT'2021), Mar 2021, Nicosia, Cyprus. {10.5441/002/edbt.2021.10}. {hal-03608624}- top core A conference
- Maroua Masmoudi, Sana Ben Abdallah Ben Lamine, Hajer Baazaoui Zghal, Bernard Archimede, Mohamed Hedi Karray,. Knowledge hypergraph-based approach for data integration and querying: Application to Earth Observation. Future Generation Computer Systems, Volume 115, 2021, Pages 720-740, ISSN 0167-739X, <https://doi.org/10.1016/j.future.2020.09.029> - core A journal
- Swaileh, W., Kotzinos, D., Ghosh, S., Jordan, M., Vu, NS., Qian, Y. (2021). Versailles-FP Dataset: Wall Detection in Ancient Floor Plans. In: Lladós, J., Lopresti, D., Uchida, S. (eds) Document Analysis and Recognition – ICDAR 2021. Lecture Notes in Computer Science(), vol 12821. Springer, Cham. https://doi.org/10.1007/978-3-030-86549-8_3 - core A conference

Successful applications for several projects

- Start of the ESPADON project (PIA/EquipEx+, 8,4 M€), with the WP Data co-led by Dan Vodislav, and the successful application of the MediaPat PhD project, funded by Fondation des Sciences du Patrimoine, focusing on the first steps in the design of the ESPADON data model, functional and system architectures.
- 1 ANR project ProTEXT with principal investigator N. Grozavu transferred to CYU from Paris 13.
- 2 EUTOPIA PhD Co-tutelle fundings: V. Christophides and S. Vu with University of Ljubljana and D. Kotzinos with VUB (2 projects). Industrial collaboration with SAP (V. Christophides).
- Industrial collaboration with SAP (V. Christophides, 50 K€).
- SEQUENCIA, the second spin-off of ETIS, created end of 2020 with SATT Erganeo, is also supported by the CNRS Rise program (June 2021).

New members

- Recruitment of a new PR (Nistor Grozavu, PR CYU) and of an MCF (Michele Linardi, MCF CYU, in replacement of Claudia Marinica, left in 2020)

Synthesis of the research activity in 2021

The activity of the MIDI team continued along the existing projects in the various research areas.

In the area of Data Integration and Analytics for multiple modalities, the work on modelling and mining indoor trajectories, in collaboration with the Louvre (PhD of Alexandros Kontarinis [Phd2]) was finalized and led to a journal publication on the trajectory model [J3]. The work on social network content and graph analysis continued in the field of opinion mining with a study of the evolution of the political opinion during electoral periods [J2] (OpLaDyn project, in collaboration with LPTM at CYU and international partners), a preliminary model for opinion extraction [C5], but also in the area of community detection [J4]. In the field of data integration using knowledge graphs, two results are to be mentioned: a knowledge hypergraph approach applied to earth observation data [J7], and a data-driven solution for an agriculture case study [C3]. Knowledge graphs are also used to propose an original recommendation method for high velocity data streams [J6]. In the field of image indexing, the work on a new feature-based image classification method [C8] was used to propose a new method for automatic image annotation [J5]. In the field of biometric characteristics analysis, methods for fingerprints [J8] and toe prints [C10] have been explored. Moreover, team member lead ongoing work on relational database theory concerning inconsistencies [R1] and four-valued semantics for deductive databases [R2].

In the area of Distributed, Online and Deep Learning, we outline the publication this year in IEEE Transactions on Pattern Analysis and Machine Intelligence (core A*), of the paper on the PhD work of Diogo Luvizon (ended in 2019), on real-time action recognition in videos [J1]. The work on vehicle identification using deep learning (PhD of Mohamed Dhia Besbes [Phd3]) has been finalized with a presentation of a progressive learning method [C9]. In this area we should also mention [C10], which introduces a novel method for representing and classifying two-person interactions from 3D skeleton sequences via Gaussian distributions capturing statistics on R^n and those on the space of symmetric positive definite (SPD) matrices. Incipient work on learnable triangulation

for 3D reconstruction from images is published in [R3] as well as [R4], and on skeleton-based hand gesture recognition is published in [C7]. Various results on anomaly detection using self-supervision are reported in [C6]. The continuation of the work in the Verspera projects on automatic 3D reconstruction of Chateau de Versailles from ancient plans, with a deep learning-based method for the detection of walls in ancient floor plans [C4]. Last but not least, [C13] [C14] propose efficient scheduling methods of continuous analytics operators over distributed nodes in an Edge/Fog/Cloud architecture for processing on the fly IoT data streams by considering time (latency) constraints.

In the emerging research area of Responsible data science, we outline the work of V.Christophides on entity resolution with fairness constraints [C1], and on anomaly explanation [C2] (with N. Myrtakis), both published in top level conferences. We notice in the same area the defense of the PhD of Emmanouil Katsomallos on the balance between quality and privacy and privacy under preferences for user-generated Big Data [PhD1].

The work in connection with the IDHN federation, besides the new approaches developed in the Verspera project, already mentioned, was completed with a study on French Haute Cuisine analyzed through tweets of awarded Chefs [Ch1].

Several PhD projects have started this year. In the area of distributed, online, and deep Learning, they address auto supervised deep learning for fake detection (N. Larue, cotutelle Eutopia with univ. of Ljubljana) and unsupervised deep learning for object tracking in sports video (T. Senthivel, CIREX contract with PMU). In the area of data integration and analytics for multiple modalities, the projects focus on unsupervised learning for multiview heterogeneous data (X. Qian, ANR), on recommendation systems for affective contexts (Y. Khalafaoui), and on two interdisciplinary topics: automatic structuring of large photographic collections taken on restauration sites, with application to the Notre Dame case (L. Willot, FSP/Notre Dame), modeling and management of augmented heritage objects (A. Stoleru, FSP/Espadon). In the area of responsible data science, we start another interdisciplinary project, on legal issues related to data protection in the context of smart city applications (A. Calvi, cotutelle Eutopia with VUB).

Among the successful applications to various research project calls, we mention the two Eutopia PhD co-tutelle projects, with University of Ljubljana and with VUB, the MediaPat PhD project (A. Stoleru) obtained at the FSP call, the CIREX CYU contract with PMU (PhD T. Senthivel), and the industrial contract with SAP. To be mentioned also, the start of the Espadon project (PIA/Equipex+), where MIDI participates and co-leads the WP Data, and in which context the was obtained the MediaPat FSP project.

KPI of MIDI in 2021

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)
 - 1 PU Emeritus: D. Laurent (CYU)
 - 5 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)

- 1 lecturer-researcher : H. Baazaoui (CYU, CDI arrived in 2019)
- 1 MCF on contract: W. Swaileh (CYU, CDD arrived in 2019, left in October 2021)
- 28 non-permanent members
 - 4 associated researchers: M. Malek (CYU-EISTI), S. Bornhofen (CYU-EISTI, left to the CELL team in September 2021), N. Priniotakis (CYU), H. Tabia (IBISC UPS)
 - 20 PhD students
 - 2 postdoctoral students (Syed Sadaf Ali, Asma Gharbi)
 - 2 members in contract: 1 ATER (M. Zneika) , 1 IGE (Elmahdi Sadouni, left in September 2021)

Publications

<i>Journal Papers</i>	<i>Conferences</i>	<i>National</i>	<i>Dissemination</i>	<i>Book</i>	<i>Chapter</i>	<i>Patent</i>	<i>Thesis</i>	<i>Others</i>
8	14	1			1		3	9

Publications with others teams of ETIS

<i>Journal Papers</i>	<i>Conferences</i>	<i>National</i>	<i>Dissemination</i>	<i>Book</i>	<i>Chapter</i>	<i>Patent</i>	<i>Thesis</i>	<i>Others</i>
	1							1

Ongoing PhD

<i>Name</i>	<i>Supervisor</i>	<i>Partner</i>	<i>Type</i>	<i>Start</i>	<i>Title</i>
ATTOLOU	D. Kotzinos / A. Tzompanaki	-	ED	01/10/2020	Explanations for missing recommendations provided by machine learning based recommendation systems
BEN CHARRADA	H. Tabia	AUSY	CIFRE	06/05/2019	3D reconstruction of real environment with deep learning
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

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. Triantafyllou	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
QIAN	N. Grozavu, M. Clausel	Univ. de Lorraine	ANR	10/11/2021	Apprentissage non-supervisé interprétable de données hétérogènes multivues
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
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
JEZEQUEL	VU HISTACE	IDEMIA	CIFRE	01/09/2020	Spoof detection by semi-supervised deep learning

PhD Defended

Name	Supervisor	Partner	Type	Start	Date of defended	Length	Title
Emmanouil KATSOMALLOS	D. Kotzinos / A. Tzompanaki	-	ED	01/10/2016	13/12/2021	62	Quality and privacy of user-generated Big Data: algorithms and techniques

Alexandros KONTARINIS	D. Kotzinos, K. Zeitouni, D. Vodislav / C. Marinica	David, Louvre	FSP	01/10/2016	13/12/2021	62	Mining and analysis of enriched trajectories - Application to museum visitor trajectories
Mohamed Dhia BESBES	H. Tabia, B. Ben Hamed	Univ. Sfax	Co-tutelle	19/08/2018	30/06/2021	34	Vehicle identity recognition by deep learning

New contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
EUTOPIA PhD Co-tutelle N. Larue	CYU/Ljubljana	Thesis	CHRISTOPHID ES, VU	01/10/2021			
EUTOPIA PhD Co-tutelle A. Calvi	CYU/VUB	Thesis	KOTZINOS	01/10/2021			
SAP	ENSEA	Contrat de prestation	CHRISTOPHID ES	15/06/2021	1 year 4 months	50 000€	50 000€
PMU PhD Senthivel	CIREX CYU	PhD	BORZIC, VU		3 years	165 000€	165 000€
PROJET RECHERCHE EMERGENT	ENSEA/SRV	APPEL SRV	CHRISTOPHID ES	2021	1 year	700€	700€
MAP InStoRe	CNRS	DIM	VODISLAV	03/02/2021	8 years	50 000€	50 000€
AAP INS2I ETIS FOR ELLES	CNRS	INS2I	TZOMPANAKI	10/02/2021	10 months	5000€	5000€
FSP 2021 MEDIAPAT	Fondation des Sciences du Patrimoine	PhD	VODISLAV	01/12/2021	3 years	119 600 €	119 600 €
ESPADON	PIA3	Equipex +	VODISLAV	01/11/2021	8 years	8,4 M€	45 000 €

Ongoing Contracts

Name	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
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 CLUSTER	Fondation des Sciences du Patrimoine	PhD	VODISLAV	01/11/2020 postponed to 01/10/2021	3 years	119 600€	119 600€
BIG DATA / BIGAI	PIA	PhD	KOTZINOS	01/02/2020	36 months	117 500€	117 500€
DforDetection	INEX	Post-Doc	PICARD	1/10/2019	2 years	112 000€	112 000€
SoCoRe !	ANR Flash Science Ouverte	Post-Doc	VODISLAV	01/10/2019	2 years	96 000€	96 000€
MOSCCOW	CNRS 80 PRIME	PhD	BORZIC	01/10/2019	3 years	0€	0€
BDBE	INEX	Post-Doc	KOTZINOS	01/09/2019	2 years	112 000€	112 000€
IDEMIA	ENSEA	CIFRE	VU	01/08/2020	3 years	147 000€	45 000€
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€
ANIMA	Horizon2020		KOTZINOS	01/10/2017	4,25 years	7482118€	296000€

Scientific Dissemination

Invited Talks/Seminars

V. Christophides : "Explainable Anomaly Detection", Invited Presentation at the Annual Plenary Workshop of the GDR IA, 1-2 December 2021

Event organization

V. Christophides: Tutorial Chair of the 21st International Conference on Web Engineering (ICWE), Biarritz, France, May 18-21, 2021 (<https://icwe2021.webengineering.org>).

Program Committee Members

D. Vodislav: BDA 2021
A.Tzompanaki: EDBT 2021
A.Tzompanaki: ICWE 2021
A.Tzompanaki: BDA 2021 (demonstrations)
A.Tzompanaki: AIML 2021
A.Tzompanaki: DOLAP 2021
A.Tzompanaki: Seadata 2021

Steering committees

1. V. Christophides: Member of the EDBT Association (since 2014) and of the Executive Board (since 2019)
2. V. Christophides: Member of the Advisory Board of the MADICS Action on Human Explainable machine Learning Pipelines (since 2021)

Expert in Scientific Programs

1. V. Christophides: ERC Advanced Grant, Reviewer 2021
2. V. Christophides: CY Initiative of Excellence, Fellows-in-Residence Prog. 2021 (Member of the Reviewing Board)
3. D. Kotzinos : ERC Starting Grant, Reviewer 2021

Local and National Scientific Responsibilities

D. Vodislav: Deputy Vice-President for Research, CYU, and Director for Research of CY Tech Engineering School

D. Vodislav: member of the Scientific Steering Committee of DIM MAP

D. Vodislav: member of the National Steering Committee of BDA, the French scientific community in the field of Data Management and Applications

Research perspectives for 2022

The significant evolution in the composition of the MIDI team these last years, with the recruitment of 2 PU and 2 MCF since 2019, will continue in 2022 with the replacement of the last MCF departure from ENSEA. As mentioned, the team strategy is to move towards a more integrated team, with research profiles around new machine learning methods for massive data analysis, encompassing various data modalities, from structured data to text, image and video. In this context, we are interested in exploring machine learning methods for general structures such as graphs, which appear in the analysis of various types of data, including not pre-structured ones.

The team will continue the effort in the field of cultural heritage data management, through various collaborative projects in the framework of the Fondation des Sciences du Patrimoine, in particular in connection with the Espadon project, whose data modeling and management strategy will impact the heritage science community. The team also prepares several applications to the ANR calls, including JCJC for young MCF, that we support in their projects.

We will also continue the effort for applying for EU calls, as already done this year – a special highlight is to be put on the participation of D. Kotzinos to the ERC Synergy project in collaboration with the CYU LERMA lab in astrophysics, whose results are expected in 2022. Also, several projects are in preparation for the local calls of CY Initiative, with a special emphasis on the collaborations in the framework of the Eutopia alliance, already initiated these last years.

Another important objective for 2022 is the start of the collaboration with researchers from Singapore (A*STAR, NUS), in the context of the IPAL CNRS International Research Laboratory on Artificial Intelligence, in which ETIS becomes a partner. Several contacts and research projects are in progress and will be presented at the SinFra IPAL workshop in June 2022, with the goal of starting co-supervised PhD projects with the Singaporean partners.

Publications 2021

Journals

- [J1] Diogo Luvizon, David Picard, Hedi Tabia. Multi-task Deep Learning for Real-Time 3D Human Pose Estimation and Action Recognition. *IEEE Transactions on Pattern Analysis and Machine*

Intelligence, Institute of Electrical and Electronics Engineers, 2021, 43 (8), pp.2752--2764. ([10.1109/TPAMI.2020.2976014](https://doi.org/10.1109/TPAMI.2020.2976014)). ([hal-02558843](#))

- [J2] Tomás Mussi Reyero, Mariano G Beiró, J Ignacio Alvarez-Hamelin, Laura Hernández, Dimitris Kotzinos. Evolution of the political opinion landscape during electoral periods, *EPJ Data Science*, 10 1 (2021) 31, DOI: <https://doi.org/10.1140/epids/s13688-021-00285-8>
- [J3] Kontarinis, A., Zeitouni, K., Marinica, C., Vodislav, D., Kotzinos, D. Towards a semantic indoor trajectory model: application to museum visits. *Geoinformatica* 25, 311–352 (2021). <https://doi.org/10.1007/s10707-020-00430-x>
- [J4] Jean-Philippe Attal, Maria Malek, Marc Zolghadri. Overlapping community detection using core label propagation algorithm and belonging functions. *Applied Intelligence*, Springer Verlag (Germany), 2021, 51 (11), pp.8067-8087. ([10.1007/s10489-021-02250-4](https://doi.org/10.1007/s10489-021-02250-4)). ([hal-03180441](#))
- [J5] Filali, J., Zghal, H.B. & Martinet, J. OntoAnnClass: ontology-based image annotation driven by classification using HMAX features. *Multimedia Tools Appl* 80, 6823–6851 (2021). <https://doi.org/10.1007/s11042-020-09864-9>
- [J6] Hemza Ficel, Mohamed Ramzi Haddad, Hajer Baazaoui Zghal,. A graph-based recommendation approach for highly interactive platforms. *Expert Systems with Applications*, Volume 185, 2021, 115555, ISSN 0957-4174, <https://doi.org/10.1016/j.eswa.2021.115555>
- [J7] Maroua Masmoudi, Sana Ben Abdallah Ben Lamine, Hajer Baazaoui Zghal, Bernard Archimede, Mohamed Hedi Karray,. Knowledge hypergraph-based approach for data integration and querying: Application to Earth Observation. *Future Generation Computer Systems*, Volume 115, 2021, Pages 720-740, ISSN 0167-739X, <https://doi.org/10.1016/j.future.2020.09.029>
- [J8] S. S. Ali, V. S. Baghel, I. I. Ganapathi, S. Prakash, S. Vu and N. Werghi, "A novel technique for fingerprint based secure user authentication," in *IEEE Transactions on Emerging Topics in Computing*, doi: 10.1109/TETC.2021.3130126.

Conference papers

- [IC1] Vasilis Efthymiou, Kostas Stefanidis, Evaggelia Pitoura, Vassilis Christophides. FairER: Entity Resolution With Fairness Constraints. 30th ACM International Conference on Information & Knowledge Management (CIKM '21), Nov 2021, New York, France. ([10.1145/3459637.3482105](https://doi.org/10.1145/3459637.3482105)). ([hal-03608623](#))
- [IC2] Nikolaos Myrtakis, Vassilis Christophides, Eric Simon. A Comparative Evaluation of Anomaly Explanation Algorithms. 24th International Conference on Extending Database Technology (EDBT'2021), Mar 2021, Nicosia, Cyprus. ([10.5441/002/edbt.2021.10](https://doi.org/10.5441/002/edbt.2021.10)). ([hal-03608624](#))
- [IC3] Asanee Kawtrakul, Hutchatai Chanlekha, Kitsana Waiyamai, Thanapat Kangkachit, Laurent d'Orazio, Dimitris Kotzinos, Dominique Laurent, Nicolas Spyrtas. Towards Data-and-Innovation Driven Sustainable and Productive Agriculture: BIO-AGRI-WATCH as a Use Case Study. 2021 IEEE International Conference on Big Data (Big Data), 2021, pp. 3407-3415, doi: 10.1109/BigData52589.2021.9671520.
- [IC4] Swaileh, W., Kotzinos, D., Ghosh, S., Jordan, M., Vu, NS., Qian, Y. (2021). Versailles-FP Dataset: Wall Detection in Ancient Floor Plans. In: Lladós, J., Lopresti, D., Uchida, S. (eds) *Document Analysis and Recognition – ICDAR 2021. Lecture Notes in Computer Science()*, vol 12821. Springer, Cham. https://doi.org/10.1007/978-3-030-86549-8_3
- [IC5] Kossi Folly, Maria Malek, Dimitris Kotzinos. Social networks analysis for opinion model extraction. *Networks 2021: first combined meeting of the International Network for Social Network Analysis (Sunbelt XLI), and the Network Science Society (NetSci 2021).*, Jul 2021, Indiana, United States. ([hal-03199000](#))
- [IC6] Loic Jezequel, Ngoc-Son Vu, Jean Beaudet, Aymeric Histace. Fine-grained Anomaly Detection via Multi-task Self-Supervision. *AVSSP 2021, IEEE*, Nov 2021, Washington (Virtual), United States. ([hal-03387879](#))

- [C7] Xuan Nguyen, Luc Brun, Olivier Lézoray, Sébastien Bougleux. *Learning Recurrent High-order Statistics for Skeleton-based Hand Gesture Recognition*. *International Conference on Pattern Recognition (ICPR - IEEE)*, 2021, Milan (virtual), Italy. (hal-03107675)
- [C8] Jalila Filali, Hajer Baazaoui Zghal, Jean Martinet: *Comparing HMAX and BoVW Models for Large-Scale Image Classification*. *KES 2021*: 1141-1151
- [C9] M. D. E. Besbes, H. Tabia, Y. Kessentini and B. B. Hamed, "Progressive Learning With Anchoring Regularization For Vehicle Re-Identification," *2021 IEEE International Conference on Image Processing (ICIP)*, 2021, pp. 1154-1158, doi: 10.1109/ICIP42928.2021.9506152.
- [C10] Syed Sadaf Ali, Vivek Singh Baghel, Iyyakutti Iyappan Ganapathi, Surya Prakash, Ngoc-Son Vu, Naoufel Werghi. "Toe Prints: An Application Study for Biometric Verification in Adults", *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops*, 2021, pp. 1418-1424
- [C11] Xuan Son Nguyen. *GeomNet: A Neural Network Based on Riemannian Geometries of SPD Matrix Space and Cholesky Space for 3D Skeleton-Based Interaction Recognition*. *ICCV 2021*: 13359-13369 (hal-03720244)
- [C12] Sandip Purnapatra, Nic Smalt, Keivan Bahmani, Priyanka Das, David Yambay, Amir Mohammadi, Anjith George, Thirimachos Bourlai, Sébastien Marcel, Stephanie Schuckers, Meiling Fang, Naser Damer, Fadi Boutros, Arjan Kuijper, Alperen Kantarci, Basar Demir, Zafer Yildiz, Zabi Ghafoory, Hasan Dertli, Hazim Kemal Ekenel, Son Vu, Vassilis Christophides, Dashuang Liang, Guanghao Zhang, Zhanlong Hao, Junfu Liu, Yufeng Jin, Samo Liu, Samuel Huang, Salieri Kuei, Jag Mohan Singh, Raghavendra Ramachandra. *Face Liveness Detection Competition (LivDet-Face) - 2021*. *IJCB 2021*, pp. 1-10, doi: 10.1109/IJCB52358.2021.9484359
- [C13] Patient Ntumba, Nikolaos Georgantas, Vassilis Christophides. *Efficient Scheduling of Streaming Operators for IoT Edge Analytics*. *FMEC 2021 - Sixth International Conference on Fog and Mobile Edge Computing*, Dec 2021, Gandia, Spain. (hal-03413549)
- [C14] Patient Ntumba, Nikolaos Georgantas, Vassilis Christophides. *Scheduling Continuous Operators for IoT Edge Analytics*. *EdgeSys '21 - 4th International Workshop on Edge Systems, Analytics and Networking colocated with EuroSys'21*, Apr 2021, Online United Kingdom, United Kingdom. pp.55-60, (10.1145/3434770.3459738). (hal-03208518v2)

Chapters

- [Ch1] Julien Longhi, Vincent Marcilhac, Felipe Diaz-Marin, Zakarya Després, Claudia Marinica. *Heritage and Creativity in the French Haute Cuisine Through the Tweets of 2 and 3 Michelin Star Chefs*. Eric Olmedo & Rachel Chan Suet Kay. *Indigeneity and Food: Politics, Transnationalism & Social Inclusion*, Penerbit UKM, pp.81-96, 2021, 978-967-251-215-8. (hal-03248122)

Research Reports and Preprints

- [R1] Dominique Laurent, Nicolas Spyratos. *Handling Inconsistencies in Tables with Nulls and Functional Dependencies*. 2021. (hal-03314808v2)
- [R2] Dominique Laurent, Nicolas Spyratos. *Four-Valued Semantics for Deductive Databases*. [Research Report] CY Cergy Paris Université - Laboratoire ETIS. 2021. (hal-03314702)
- [R3] Tarek Ben Charrada, Hedi Tabia, Aladine Chetouani, Hamid Laga. *Learnable Triangulation for Deep Learning-based 3D Reconstruction of Objects of Arbitrary Topology from Single RGB Images*, arXiv:2109.11844, <https://doi.org/10.48550/arXiv.2109.11844>
- [R4] Loic Jezequel, Ngoc-Son Vu, Jean Beaudet, Aymeric Histace. *Efficient Anomaly Detection Using Self-Supervised Multi-Cue Tasks*, arXiv:2111.12379, <https://doi.org/10.48550/arXiv.2111.12379>

PhD Thesis Defended

[Phd1] Emmanouil Katsomallos. *Quality and privacy of user-generated Big Data: algorithms and techniques*. Theses, CY Cergy Paris Université, December 2021. <http://www.theses.fr/2021CYUN1059>

[Phd2] Alexandros Kontarinis. *Mining and analysis of enriched trajectories - Application to museum visitor trajectories*. Theses, CY Cergy Paris Université, December 2021. <http://www.theses.fr/2021CYUN1060>

[Phd3] Mohamed Dhia Elhak Besbes. *Vehicle identity recognition using deep learning*. Theses, CY Cergy Paris Université, June 2021. <http://www.theses.fr/2021CYUN1020>

Publications of new team members (outside ETIS)

Journals

[J'1] Paul Boniol, Michele Linardi, Federico Roncallo, Themis Palpanas, Mohammed Meftah, Emmanuel Remy. *Unsupervised and scalable subsequence anomaly detection in large data series*. *VLDB Journal*, Vol. 30(6), pages 909-931, 2021.

[J'2] Alice Recanati, Nistor Grozavu, Younes Bennani, Cécile Gautheron, Yves Missenard., *Apatite (U-Th-Sm)/He date dispersion: First insights from machine learning algorithms*. *Earth and Planetary Science Letters*, Volume 554, 2021, 116655, ISSN 0012-821X, <https://doi.org/10.1016/j.epsl.2020.116655>.

Conference papers

[C'1] Chevallier, M., Rogovschi, N., Boufarès, F., Grozavu, N., Clairmont, C. *Detecting Near Duplicate Dataset*. In: , et al. *Proceedings of the 13th International Conference on Soft Computing and Pattern Recognition (SoCPaR 2021)*. *SoCPaR 2021. Lecture Notes in Networks and Systems*, vol 417. Springer, Cham. https://doi.org/10.1007/978-3-030-96302-6_36

[C'2] M. Chevallier, F. Boufarès, N. Grozavu, N. Rogovschi and C. Clairmont, "Near duplicate column identification: a machine learning approach," *2021 IEEE Symposium Series on Computational Intelligence (SSCI)*, 2021, pp. 1-7, doi: 10.1109/SSCI50451.2021.9659897.

[C'3] Marc Chevallier, Nicoleta Rogovschi, Faouzi Boufares, Nistor Grozavu, Charly Clairmont. *Techniques de génération de population initiale d'algorithmes génétiques pour la sélection de caractéristiques*. *9e Conférence Internationale Francophone sur la Science des Données (CIFSD)*, 2021. <https://hal.archives-ouvertes.fr/hal-03274095/document#page=36>

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 2021, 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

- "Une IA qui apprend à parler comme les bébés" vient d'être remarquée par le CNRS : <https://ins2i.cnrs.fr/fr/cnrsinfo/une-ia-qui-apprend-parler-comme-les-bebes>
- Alexandre Pitti, Mathias Quoy, Sofiane Boucenna, Catherine Lavandier. Brain-inspired model for early vocal learning and correspondence matching using free-energy optimization. PloS Computational Biology, 2021. (OpenAccess), <https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008566>
- 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>,
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0261174>
- Best Paper Award for the article: Colomer S., Cuperlier N., Bresson G., Romain O., au workshop "Human-like Behavior and Cognition in Robots" IROS (International, Conference on Intelligent Robots and Systems) "Hierarchical Sparse Dictionaries: how sparsity, topology and pooling can improve visual place recognition"
- Futurobot @ Cergy Pontoise organized by CNRS and ETIS, 8th october 2021, www.futurobot-cergy.fr
- Lola Cañamero in "50 Women in Robotics you need to know about 2021",
<https://robohub.org/50-women-in-robotics-you-need-to-know-about-2021/>
<https://womeninrobotics.org/news/>

Synthesis of the research activity in 2021

The year 2021 is a transition year. Several international collaborations with thesis grants have been accepted (universities of Brussels, Barcelona, A-STAR Singapore). The construction of a new robot with the purchase of a new Trooper navigation platform (DIM RFSI), a Reachy robot (internal fund 2020), the creation of a new animatronic robot head (internal fund 2021).

Submission of two European EIC Pathfinder Awareness Inside projects (PI Lola Canamero and Alexandre Pitti) and submission of four ANR projects (PI Ghiles Mostafaoui, Laura Cohen, Sofiane Boucenna, Alexandre Pitti), submission of one CNRS-UTokyo project and one CNRS Emergence project.

KPI

Members

At the date of 31th december 2021, the NEURO Group has:

- 13.5 permanent members:
 - 4 Full Professors
 - 8 MCF including 2 HDR
 - 1.5 CNRS Engineers.

- 11 non-permanent members:
 - 1 associated member
 - 13 PhD students including 1 caesura

Ongoing PhD

Name	Supervisor	Partner	Type	Start	Title
ANNABI	PITTI QUOY	FACEBOOK	ED	16/11/2018	Spiking neural architecture based on predictive coding for memory sequences
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
GORIOT	PITTI QUOY	IPAL ASTAR	Labex	01/02/2021	Extracting structure from sequences
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

Inter-team 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 vehicle
COLOMER	CUPERLIER BRESSION ROMAIN	VEDECOM	CIFRE	05/11/2019	Integrated neuro-robotic approaches for autonomous vehicle localisation and navigation.

PhD Defended

Name	Supervisor	Partner	Type	Start	Date of defended	Length	Title
ANNABI	PITTI QUOY	FACEBOOK	CY Fondation	16/11/2018	15/12/2021	36 months	Spiking neural architecture based on predictive coding for memory sequences
Aubin	MARIN Mostafaoui	Euromov	DGA	01/10/2017	09/12/2021	42 months	Entraînement rythmique non-intentionnel et processus attentionnels en Interaction Homme Machine

Publications

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
7	9	3					2	3

Publications with others teams of ETIS

Journal Papers	Conferences	National	Dissemination	Book	Chapter	Patent	Thesis	Others
1	1							3

Contracts

New contracts

Name	Manager	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
SRV	ENSEA	APPEL SRV	Stage	CANAMERO	Avril/oct.2021	6 months	4300€	4300€
SRV	ENSEA	APPEL SRV	Stage	BLANCHARD	Mai/nov 2021	6 months	4500€	4500€
INEX 2021 COMOCA	CYU	EMERGENCE	INEX	MOSTAFAOUI	01/09/2021	2 years	110 518€	25 000 €

DIM RFSI Matériel 2020	CNRS	Région IDF	DIM	BLANCHARD	30/01/2021	1 year 9 months	33 000€	33 000€
AAP INS2I Social Babbling	CNRS	INS2I	AAP	COHEN	10/02/2021	10 months	6000€	6000€
SFRI CO TUTELLE UTOPIA CY PhD Larue	CYU	EUTOPIA	Thesis	CANAMERO	01/10/2021	4 years	500 299 €	163 210 €
NetOPES	CYU	Labex MME-DII + ED	Thesis	QUOY	01/10/2021	3 years	114 000€	114 000€
Sciences cognitives	CYU	réseau sciences cog	Internship	QUOY	01/03/2021	6 months	4500€	4500€

Ongoing contracts

Name	Manager	Sponsor	Type	PI	Start	Length	Budget	Budget (ETIS)
DIM RFSI	CNRS	Région	DIM	BOUCENNA	15/09/2020	2 years	58 000€	58 000€
Chaire Neurobot	CYU	INEX	Chaire	QUOY	01/09/2020	5 years	408 990 €	277 000 €
INEX COGNITIVE S	PIA	INEX	Workshop	GAUSSIER	16/06/2019	4 years	55 000 €	55 000 €
Facebook	CYU	Facebook	Thesis	QUOY PITTI	01/11/2019	3 years	147 000 €	147 000 €
TREMLIN	CNRS INS2I	CNRS	Workshop	CUPERLIER	04/2020	1 year	7588 €	7588 €
CENSE	CYU	ANR	Post-doc	LAVANDIER	01/10/2016	5.5 years	855 773 €	69 444 €
ARTEM	CYU	INEA Union Européenne	workshop	LAVANDIER	01/12/2017	4 years	7.5 M€	4 000 €
ARTEM overheads	CYU	INEA Union Européenne	workshop	LAVANDIER	01/12/2017	4 years	7.5 M€	18 000 €
ANIMA	CYU	INEA Union Européenne	Thesis	LAVANDIER	19/09/2017	4 years	7.6M€	174 000 €

ANIMA overheads	CYU	INEA Union Européenn e	Thesis	LAVANDIER	19/09/2017	4 years	7.6 M€	86 680 €
SPACE CODE	CYU	Inex	Thesis	GAUSSIER	01/10/2018	36 months	188 436 €	117 500 €
Cifre THALES	CNRS	THALES	Thesis	GAUSSIER	28/03/2018	3 years	45 000 €	45 000€
ROBOCOL	CNRS	ROBOCOL	Subcontr act	GAUSSIER	26/03/2019	1 year	5 000 €	5 000 €
ROBOCOL	CNRS	ROBOCOL	Subcontr act	GAUSSIER	26/03/202 0	1 year	5000 €	5000€
CIGALE	CYU	DGAC	RTE CORAC	LAVANDIER	18/03/2019	48 months	796 000 €	15 000€
INEX SCIENCES COGNITIVE S	CYU	INEX	workshop	GAUSSIER	16/06/2019	4 years	87 811 €	55 000€
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 €

Scientific Dissemination

Invited conference

1. Alexandre Pitti, *International Workshop on Embodied Cognition*, Cambridge, march 2021.
2. Nicolas Cuperlier, *workshop SHARC du GT4*, 9 juillet 2021
3. Nicolas Cuperlier, *Séminaire thématique sur la mobilité (tremplin MOVE): 03/06/21, 15/06/21*
4. Catherine Lavandier Avril 2021 Invitedto the workshop "Urban Sounds Symposium" organisé par Ghent University (Belgique). Intervention "Post-COVID19, a lasting effect on soundscape?"
5. Catherine Lavandier June 2021 Invited to the workshop "New approaches to mitigate aviation noise impact" organisé à Vienne (Autriche) European project ANIMA. "The use of auralization and visualization tools to engage the airport community".
6. M. Quoy. *Intelligence artificielle et incarnation*. School of Digital Humanities, L'Isle-Adam, 2021.

7. M. Quoy. *Structure and dynamics of recurrent neural networks*. Local workshop on AI, Cergy-Pontoise, 2021.

Event Organization

8. *Futurobot @ Cergy* organized by the CNRS, CYU and ETIS, 8th october 2021, www.futurobot-cergy.fr
9. *Animation d'une table ronde sur les Interactions naturelles et intuitives dans la conférence Drôles d'Objets*. (<https://drolesdobjets20.sciencesconf.org/resource/page/id/10>)
10. *Program committee and chair for the GT8/GT5 of the GDR Robotique: Apprentissage et neurosciences pour l'interaction humain-robot* (<https://gt5gt82021.sciencesconf.org/>)

Perspectives for 2022

Several projects are being prepared for submission in 2022, national and European on the themes of social robotics (EIC Pathfinder, L. Canamero) and developmental robotics (ANR JCJC L. Cohen), robotics and health (ANR Arabica project accepted G. Mostafaoui), international with Singapore IPAL.

The team will continue its national interactions on autonomous vehicles (Vedecom, Expleo) on bio-inspiration (U Nanterre, Collège de France, A Pitti) and international (NUS).

New themes will be developed on ecological robotics and frugal intelligence (ERC project submitted to A Pitti) in line with European and national requirements pushed by the CNRS.

Two new research professors will be recruited for 2022, a junior professor and a permanent staff, Thanos Manos and Marwen Belkaid.

We will continue to seek to have a CNRS researcher and post-docs in our ranks, as well as staff from ENSEA and CYTECH, currently lacking in our team

Publications

Journals

1. Louis Annabi, Alexandre Pitti, and Mathias Quoy. *Bidirectional interaction between visual and motor generative models using predictive coding and active inference*. *Neural Networks*, 143 :638–656, 2021.
2. Alexandre Pitti, Mathias Quoy, Catherine Lavandier, and Sofiane Boucenna. *Brain- inspired model for early vocal learning and correspondence matching using free-energy optimization*. *PLOS One Computational Biology*, pages 1–27, 2021 <http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008566>
3. Jean-Paul Banquet, Philippe Gaussier, Nicolas Cuperlier, Vincent Hok, Etienne Save, Bruno Poucet, Mathias Quoy, and Wiener Sidney I. *Time as fourth dimension in the hippocampus*. *Progress in Neurobiology*, 199, 2021.
4. Colomer S, Cuperlier N, Bresson G, Gaussier P and Romain O (2022) LPMP: A Bio-Inspired Model for Visual Localization in Challenging Environments. *Front. Robot. AI* 8:703811. doi: 10.3389/frobt.2021.703811
5. GONTIER F., LOSTANLEN V., LAGRANGE M., FORTIN N., LAVANDIER C., PETIOT J.F., "Polyphonic training set synthesis improves self-supervised urban sound classification", *The Journal of the Acoustical Society of America*, 149, n°4309 (2021). doi.org/10.1121/10.0005277

6. LISE, AUBIN, GHILES, MOSTAFAOUI, Amiel CHLOE, HELENE, SERRE, Capde- vielle DELPHINE, Hellouin de Menibus MAELANE, Boiche JULIE, Schmidt RICHARD, Raffard STEPHANE et Ludovic MARIN. "Study of coordination between patients with schizophrenia and socially assistive robot during physical activity". In : *International Journal of Social Robotics* (2021)
7. LISE AUBIN, GHILES MOSTAFAOUI, Richard SCHMIDT, HELENE SERRE et Ludovic MARIN. "Effects of unintentional coordination on attentional load". In : *Human Movement Science* 80 (2021), p. 102880. ISSN : 0167-9457. DOI : <https://doi.org/10.1016/j.humov.2021.102880> (cf. p. 8, 58, 59, 87).

Conferences

1. Louis Annabi, Alexandre Pitti, Mathias Quoy, (2021) A predictive account for Chaotic Itinerancy, conference ICANN2021.
2. Sylvain Colomer, Nicolas Cuperlier, Guillaume Bresson, Olivier Romain, Forming a sparse representation for visual place recognition using a neurorobotic approach Conference: 2021 IEEE International Intelligent Transportation Systems Conference (ITSC).
3. Sylvain Colomer, Nicolas Cuperlier, Guillaume Bresson, Olivier Romain, Hierarchical Sparse Dictionaries: how sparsity, topology and pooling can improve visual place recognition , IROS workshop "Human-like Behavior and Cognition in Robots".2021
4. DEDIEU R., LAVANDIER C., AALMOES R., LANIA H., LEGRIFON I. BOULLET I., "Virtual reality simulated aircraft flyovers: Influence of the landscape on the overall pleasantness of the environment", InterNoise 2021, August 2021, Washington, United States. doi.org/10.3397/IN-2021-1564
5. LAVANDIER C., AUMOND P., CAN A., GONTIER F., LAGRANGE M., PETIT G., "Urban sensor network for characterizing the sound environment in Lorient (France) through an automatic assessment of traffic, voice and bird presence ratios", Proceedings of the 12th European Congress and Exposition on Noise Control Engineering, Euronoise 2021, Madeira, Portugal. <https://youtu.be/NE2PWTSdZrM>
6. CAN A., PICAUT J., ARDOUIN J., CREPEAUX P., BOCHER E., ECOTIERE D., LAGRANGE M., LAVANDIER C., MALLET V., MIETLIKY C., PABOEUF M., "CENSE Project: general overview", Proceedings of the 12th European Congress and Exposition on Noise Control Engineering, Euronoise 2021, Madeira, Portugal.
7. AUMOND P., CAN A., LAGRANGE M., GONTIER F., LAVANDIER C., "Multidimensional analysis to monitor the effects of COVID-19 lockdown on the urban sound environment of Lorient", Proceedings of the 12th European Congress and Exposition on Noise Control Engineering, Euronoise 2021, Madeira, Portugal.
8. LEMHAOURI Z., COHEN L., CANAMERO L., Affect-grounded Language Learning in a Robot, Workshop FEEL-COG ICDL 2021
9. COHEN L., NOWE A., CANAMERO L., A functionalist approach to language learning in robots: the development of meaning potentials in social and emotional contexts, Workshop HBCR IROS 2021

National workshops

1. Lise Aubin, Ghiles Mostafaoui, Ludovic Marin, Chloé Amiel, Hélène Serré, et al. Etude de la coordination interpersonnelle de patients souffrant de schizophrénie en Interaction Homme Robot. Workshop sur les Affects, Compagnons artificiels et Interactions, October 2021, Saint Pierre d'Oléron, France.
2. Ghilès Mostafaoui, Lise Aubin, Eva Ansermin, R. C. Schmidt, Ludovic Marin, Interaction naturelle et intuitive : pourquoi un objet interactif doit revêtir un caractère "non-intentionnel" ? Drôles d'objets: un nouvel art de faire, Rochelle, France, 27-29 Octobre 2021
3. A Pitti system1/system2: from discovering structure in the world to self-structuring the brain itself, International workshop on Embodied Intelligence, may 2021



ETIS
6 av du Ponceau
95000 Cergy

contact@etis-lab.fr
+33 1 30 73 66 10

etis-lab.fr