



Human factor - Embedded electronics - Artificial Intelligence



Intelligent and communicating systems - User-centered design

### WE SHARE OUR EXPERTISE



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### LE CATIE

#### **OUR MISSION**

CATIE (Centre Aquitain des Technologies de l'Information et Electroniques) is a non-profit association created in 2014 on the initiative of the Nouvelle-Aquitaine council and local companies.

Our primary mission is to support and assist SMEs and other structures in their development projects and digital transformation.

We are also involved in various research projects in the most promising fields of our technologies, in order to offer the most advanced support.

We support companies at various stages: proof of concept, consulting, assistance, expert advice and solutions, but also innovative vision and multidisciplinary analysis. CATIE helps to unlock all technological barriers the organizations that consult us may have.

This allows them to adopt and integrate innovative technologies, acquire new knowledge, have access to additional resources, and increase their skills, i.e striving for excellence and innovation.

#### OUR COMMITMENTS

We believe that digital technologies, which meet the current needs for progress, can also be ethical and responsible. We use them in design (eco-design, energy optimizations, responsible behavior inductions, ...), or in transfer towards companies for positive impact projects in order to reduce carbon footprint.

It results from our status and our scientific approach, that we guarantee strong technical requirements and technological independence, ensuring optimal and sustainable solutions for our customers.

These solutions are the dissemination of our research work, but also of specific designs, to offer companies objective technology tools to "unrisk" and accelerate their R&D.

CATIE also supports structures towards regional actors in order to consider local solutions and develop a virtuous ecosystem.

### A UNIQUE RTO IN FRANCE

CATIE is a Research and Technology Organization whose employees, mostly PhDs and engineers, come from industry and the academic world.

Their experience and expertise cover a wide range of fields: mathematics, computer science, digital and analog electronics, ergonomics, physiology, psychology, cognitive sciences, etc. This multidisciplinarity makes CATIE a unique RTO in France!

### **IN BRIEF**

#### 3 RESEARCH AND TECHNOLOGY ORGANIZATIONS IN 1

CATIE offers an original multidisciplinary approach, based on 3 main areas of expertise :

- Human factor and cognition: to define, validate and identify the acceptability, desirability and involvement
  of technologies. Our scientific tests and recommendations on User-centered design allow your solution
  not to be rejected or refused and allow you to lead, through the use, the scale-up of an organization or
  a project;
- Embedded electronics: to design, prototype and test software and hardware dedicated to the IoT. We will assist you throughout your project, from designing the sensor to implementing the IoT platform;
- Data science: to valuate your data, anticipate behaviors, automate off-putting or difficult tasks. Our team assists you in developing and deploying the suitable Artificial Intelligence model.

These 3 main disciplines, individually mastered, allow us to address more complex issues, located at the crossroads of these skills: trustworthy AI, embedded AI and enhanced human.

### CATIE is the only French RTO capable of offering all the skills needed to master these technological fields, which are at the heart of the digital transformation, all three of which evolving and extremely promising.

Close to companies, CATIE also works closely with clusters and is at the core of a large European R&D network made up of research laboratories, RTOs and EDIHs (European Digital Innovation Hub). CATIE is part of the DIHNAMIC EDIH, a hub of innovation, training and technology transfer major actors in

the Nouvelle-Aquitaine area. It offers companies services to promote access to digital technologies based on Artificial Intelligence, advanced robotics, digital twins and intelligent systems. DIHNAMIC promotes the digital and green transition with a focus on sustainable, human-centered AI for manufacturing. The Nouvelle-Aquitaine EDIH will thus support the development of Industry 5.0.

Over the period 2023-2026, DIHNAMIC will offer more than 600 support actions to circa 100 local companies, from experimentation on various technologies to training and funding.

CATIE coordinates access to test and experimentation services and will provide this hub for digital innovation with her three technology innovation platforms.

We therefore offer not only cutting-edge technologies, but also assistance in setting up regional, French and European collaborative projects.

We also actively participate in the scientific dissemination of skills that may be considered inaccessible by some structures. We thus widely disseminate our expertise and the results of our work through our technological innovation platforms.

We share free and open source innovation platforms: PEAC<sup>2</sup>H for cognitive and behavioral assessment, 6TRON for IoT and VANIILA for Artificial Intelligence. They are the main development levers to increase our actions of technological transfer.

They are also an effective way to join *consortia* and win European projects, but also to develop global reach beyond the regional area thanks to their innovative and unique side.

#### PROJECTS TECHNOLOGICAL MATURITY LEVELS



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5 national and international awards centre de ressources technologiques



### DATA SCIENCE & ARTIFICIAL INTELLIGENCE

#### ad@catie.fr

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#### FROM DATA PROCESSING TO ARTIFICIAL INTELLIGENCE

Research and development, technology surveillance, working and industrializable prototype, skills transfer

#### Artificial Intelligence

HIGH\_PRIORITT\_STREAM: U

Automatic speech recognition Automatic Natural Language Processing Computer vision Time series Deployment of AI models

#### **Related skills**

Big data Cloud Architecture Consulting Data visualization Cybersecurity Blockchain pNCCL.cpp:1196] NCCL\_DEBUG: N/A ghtning/callbacks/model\_checkpos xists and is not empty. path} exists and is not empty.") ,3,4] ,3,4]

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NEURAL NETWORKS, MACHINE LEARNING, DATA SCIENCE, EXPLAINABILITY, LEARNING WITH LITTLE DATA

## POWERFUL SERVERS FOR CALCULATIONS

CPU : 2 Intel Xeon Gold 6132 GPU : 10 Tesla T4 16 GB RAM : 188 GB Storage : 3,5 TB

CPU : 4 Intel Xeon Gold 6262V RAM : 500 GB Storage : 14 TB





CPU : 2 Intel Xeon Gold 6140 GPU : 3 Quadro RTX 6000 24 GB RAM : 500 GB Storage : 2 TB

CPU : 2 AMD EPYC v2 7452 GPU : 5 Tesla A100 (3x40 GB + 2x80 GB) RAM : 256 GB Storage : 4 x 3,84 TB





# HUMAN FACTOR & COGNITION

#### sch@catie.fr

# **Designing** for Situation

# COGNITION

nsformations digitales à l'épreuve de l'activité et du

Psychologie du jugeme et de la décision

**FROM ANALYSIS** TO USER-CENTERED DESIGN

Research and development, proof of concept, technology surveillance, skills transfer, support and development of prototypes

New technologies for training Links between user profiles / technology capabilities / educational content

Verbal and non-verbal communication Communication & collaboration man - machine (face-to-face, hybrid, remote)

Innovative human-machine interactions Design adapted to uses, tasks, technical and human limits

Physiology of human being Detection of cognitive states and integration of multi-sensor physiological signals

Acceptability and trust in AI Design of Artificial Intelligence models adapted to the user's characteristics

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action à la psychologie cognitive HUMAN PHYSIOLOGY, USER TESTING, COGNITION, BEHAVIORAL ASSESSMENTS, AR / MR / VR, SCIENTIFIC METHODS, METHODOLOGICAL TOOLS

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### INNOVATIVE TECHNOLOGIES MADE AVAILABLE

You can find all this equipment in our experimental room on page 17



**Physiological analysis:** Eye trackers Motion capture EEG, ECG, EDA, ...

Simulators: Cockpit of the future Autonomous vehicle Remote communication and collaboration, ...



**3D visualization technologies:** Tablets Video projectors VR / AR / MR equipment, ...

> Interaction devices: Connected gloves and jackets Vibration technologies Z-Space, Optitrack, ...





# ELECTRONICS & EMBEDDED SYSTEMS

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#### FROM SENSOR TO FEEDBACK FOR IOT PLATFORMS

Research and development, technological surveillance, ecodesign, functional and industrializable prototyping, skills transfer

#### Electronics and embedded systems

Analog and power electronics Microprocessors, microcontrollers, FPGA Communicating systems Pre-emptive multi-tasking operating systems

#### **Related skills**

IIoT Platform Embedded Artificial Intelligence Cybersecurity Energy harvesting Robotics (perception, motor control, ...)

> Embedded Artificial Intelligence, LOW POWER SYSTEMS, COMMUNICATING AND INTELLIGENT SYSTEMS

### EQUIPMENT ADAPTED TO YOUR NEEDS

Development: Power supply 600W Random signal generator 3GHz universal counter Thermal camera Climatic chamber

Electronic design: Manual welding bench Altium Designer SIWave









Measurement: 6GHz, 400MHz oscilloscopes 4 isolated channels on battery 350 MHz Precision multimeter Power analyzer Datalogger

Robotics: Cobotic arm (Doosan 0609) Tiago robot 3D Lidar Realsense camera

# EMBEDDED ARTIFICIAL INTELLIGENCE

Preparing tomorrow

Embedded Artificial Intelligence is the integration of AI systems on various hardware targets

The integration of Artificial Intelligence algorithms as close as possible to the sensor allows a significant reduction in energy consumption and system response time. Local decision-making abilities generate a significant reduction in data protection risk as data is not transmitted in the Cloud.

Use cases: predictive maintenance, intelligent sensors, robotics, ...

OUR EXPERTS OPTIMIZE ALGORITHMS TO EMBED THEM IN ANY ELECTRONIC SYSTEM

# TRUSTWORTHY ARTIFICIAL INTELLIGENCE

Preparing tomorrow

Build a trust relationship between humans and intelligent systems so that answers provided by the digital system are understood and accepted

Trustworthy Artificial Intelligence is a robust, transparent and explainable AI that is interpretable and understandable in accordance with the context of use but also the expectations and capabilities of the end user.

Al is often seen as a system with little or no human understanding of how it works and how it responds, making the technology difficult to be accepted.

The goal of trustworthy AI is to provide a clearer and more appropriate response to the target audience, including ethical dimension. A system in which AI is integrated will be more used and accepted if it is understandable and accessible.

Use cases: voice assistants, decision-making support, robotics, ...

OUR EXPERTS CREATE ALGORITHMS BASED ON HUMAN EXPERTISE

# ENHANCED

### HUMAN

Preparing tomorrow

The enhanced Human being can be defined by the improvement of human capacities thanks to electronic systems

The analysis of human behavior and the recovery of physiological monitoring data allow to design enhanced electronic systems that improve users' motor, cognitive and physiological performance.

The interaction and collaboration between human being and machine (or robot) can be done through various technological supports such as Virtual Reality, Augmented Reality or Mixed Reality, connected watches, etc.

Use cases: voice recognition, sports training, 4.0 industry, autonomous vehicle, robotics, etc.

Our experts design embedded systems adapted to the users' environment and to their characteristics

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## AUTONOMOUS AND COLLABORATIVE ROBOTICS

#### Preparing tomorrow

The multidisciplinary environment created by our three activity fields is perfectly illustrated by robotics and cobotics

It is now possible to design autonomous systems able to interact with their environment. Based on heterogeneous but complementary technology cores, robotics is the perfect example. We take up challenges such as moving in an unknown environment, interacting in natural language, as well as recognizing and grasping objects, and integrate the related technological advances into our demonstrators.

The technological developments that can be transferred to our partners are tested during international competitions.

Use cases: personal assistance robot, AGV, industrial cobotics, etc.

#### RANKING

GERMAN OPEN 2019: 2ND PLACE ROBOCUP 2019 (SIDNEY): 3RD PLACE SCIROC 2019: 2ND PLACE ROBOCUP 2021 (VIRTUAL): 2ND PLACE Our experts collect, process and embed Artificial Intelligence, human factor and electronics





### OUR TECHNOLOGICAL INNOVATION PLATFORMS

#### Around future-oriented themes



The 6TRON platform aims to support companies in the development of their own electronic solutions for the **Internet of Things.** 

# INTERNET

**OF THINGS** 

It provides open source hardware and software resources to help organizations imagine, develop and operate new services. It also eases the creation of ready-to-produce prototypes.

HTTPS://6TRON.IO/



PEAC<sup>2</sup>H is a free online service for SMEs. It offers them quick and independent access to human factor related resources and competences to design their own digital system.

### BEHAVIOR ANALYSIS AND ASSESSMENT

Its aim is to integrate human beings in complex and innovative systems, by means of turnkey customized or evaluation protocols and methodological tools.

#### HTTPS://PEAC2H.IO/



VANIILA is a working and computing environment. It was conceived and designed to create AI potential awareness and to support companies in developing their expertise.

### ARTIFICIAL

### INTELLIGENCE

Entities have SSH access to rented servers and interactive notebooks.

Use cases, technology cores and technical articles are also available.

HTTPS://VANIILA.AI/

### OUR TECHNOLOGY DEMONSTRATORS



The experimental room gathers technologies used within the CATIE. Companies may generally have no or limited access to them as people do not necessarily know how to use or operate them.

These companies can test and prototype applications by themselves, but can also train themselves and carry out experiments.

This dedicated, modular and adaptable space is accessible to structures that wish to carry out all tests required by user-centered design, either on their own or with our expert support.

**EPOCK : test, evaluation and demonstration equipment** Epock is a robot based on a set of technology cores found within our three main areas of expertise.

It perfectly demonstrates the complementarity of CATIE's expertise in international robotics competitions (RoboCup@ Home category).

The achieved results ensure the technologies robustness which, once proven, can be transfered to industry.





#### Showroom

This device highlights the Augmented Reality techniques developed within the CATIE.

Visitors can use it in complete autonomy to learn about the technical characteristics of our 6TRON electronic boards or to evaluate the electro-magnetic waves of the various components.

### REGIONAL PRESENCE IN NOUVELLE - AQUITAINE

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**CATIE** Centre de Ressources Technologiques

Web sites Let's go further!





6TRON.IO/

**6TRON** 

PEA2CH.IO/



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